TECHNICAL MANUAL

OPERATOR'S MANUAL

RADIOSONDE RECORDERS
AN/TMQ-5 (NSN 6660-00-324-9426)
AN/TMQ-5A (NSN 6660-00-393-2234)
AN/TMQ-5B (NSN 6660-00-393-2234)
AN/TMQ-5C (NSN 6660-00-682-4500)

This copy is a reprint which includes current pages from Changes 1 through 7. The title was changed as shown above by Change 5.

HEADQUARTERS, DEPARTMENT OF THE ARMY
OCTOBER 1969

WARNING

HIGH VOLTAGE

is used in this equipment.

DEATH ON CONTACT

may result if operating personnel
fail to observe safety precautions.

DON'T TAKE CHANCES!

*420061AB26A
GP
Jul 80

THE EVALUATION OF THE RADIOSONDE RECORDER RECORD

GUIDANCE PACKAGE

This guidance package must be used in conjunction with GP Workbook 4620061AB27A dated Jul 80

U.S. ARMY
FIELD ARTILLERY SCHOOL
Counterfire Department
Fort Sill, Oklahoma

*Supersedes GP 420061AB26A, Jul 78.

WC-859

To The Student:

The material that you are about to study is in the form of two modified self-instructional booklets. It is understood that you may need some additional help in your learning process of this subject material. Therefore, do not forget that the classroom instructor is here to help you in case you need it.

This booklet will consist of instruction where you will learn how to evaluate the radiosonde recorder record. The second booklet that you must use in conjunction with this one is a workbook. The workbook (WB) consist of many examples of significant points in recorder record evaluation.

When this text explains a certain phase of instruction and refers to an example in the WB, please have the workbook open and have that example before you. The WB permits you to perform all the activities in evaluation of the recorder record. Do not be overly conscious of time. You are not racing the clock or competing with your classmates. Your competition is you. So be alert and make every effort to comprehend the material. However, if after a conscientious effort on your part, you still do not understand some phase, consult the instructor. Throughout the two booklets, the instructor will check your work or verify your answers. Please check with the instructor when told to do so.

INTRODUCTION

The importance of being proficient in evaluating the radiosonde recorder record accurately cannot be overemphasized. The learning of the material presented in this block of instruction is the basis for obtaining all data to produce a met message. The recorder operator (RO) must master all aspects in the evaluation of the record. It behooves the RO to do his or her best since all other team members' activities depend on the accuracy of the evaluated record. To put all of this in simple terms, if the firing battery is to hit the target, it must have a good met message. In order to produce a good met message, the recorder record must be evaluated fast but more important it must be evaluated accurately. There are six task listed in the soldier's manual MOS 93F that must be learned in order for you to accomplish the terminal objective listed below. These task are listed by number on page i of the workbook (WB) 27A. Turn to page i of WB 27A now and look these task over. At the present time these task may seem hard and difficult. However, each task will be explained and you will perform each several times in order to become proficient to the degree of competence required by the objective.

TERMINAL OBJECTIVE

Given a radiosonde recorder record, a CP-223 Computer, and surface data, evaluate the record to end of the requirement to include the completion of the radiosonde data sheet. The tolerances of your evaluations must not exceed ±0.2 ordinates, ±0.2°C for temperature, ±2 percent for humidity, and ±2 millibars in pressure with no more than five errors and failing to place no more than one level.

SECTION I

1. The recorder record contains a series of temperature and humidity traces representing weather conditions from surface to the top of that weather sounding. Since each radiosonde comes packed with its own pressure calibration chart, we can determine the pressure by use of the chart for any point in the atmosphere that the radiosonde passes through. By evaluating the record and using a CP-223 Computer (circular slide rule), we can determine temperature and humidity at any point in the atmosphere that the radiosonde passes through. However, instead of evaluating every trace printed on the record, we have a method of evaluating just points of significant change. You will learn how to evaluate the data in determining where significant weather changes occur on the record.

EXERCISE 1. By evaluating the recorder record, you can determine pressure and significant changes of _____ and _____.

2. RECORD BASELINE AND PURPOSE

At this time turn to page 1 of the workbook (WB). Keep this page of the WB before you as we discuss the recorder record. This page shows a typical record of a radiosonde flight. The record has been evaluated according to the procedures that you will be using later. Look over the complete record and then look back down to the bottom portion (the baseline check). A baseline was established then evaluated for this flight. This is a must for each and every flight. The purpose of the baseline is to give us a relationship between recorder divisions and the actual temperature and humidity within the baseline checkset chamber. After the baseline traces on the record are evaluated (as shown on record 1), the data was set in on the computer. This gives us a means of evaluating significant weather changes indicated on the record. If you will look upward on the record, you can see there are 12 (0 thru 11) lines drawn across the chart. These horizontal lines are known as levels and were drawn at points on the chart of significant changes or were placed at mandatory pressure levels. Thus with the computer properly set with baseline data, each of the levels can be evaluated for actual temperature and humidity. Each level can also be evaluated for pressure.

EXERCISE 2. The baseline check is performed in order to set up a relationship between recorder divisions values and actual _____ and _____.

3. How to Perform the Baseline.

a. This paragraph will teach you how to perform part of task number 2006. The part of the task in how to set up and operate the equipment, you will learn later in module six. There are some requirements that must be followed in order for a baseline to be valid. These requirements are as follows:

(1) There must be at least 5 low reference traces printed on 95.0 recorder divisions without adjustment.

Note: From now on in this guidance package we will refer to recorder division values as just RD values.

(2) Within the prescribed low reference traces (above) there must be two successive temperature traces that are identical (same RD value).

(3) Also within the prescribed low reference traces, there must be two successive humidity traces that are identical.

Note: If the humidity traces are trending (not staying at same RD value), three traces can be used if the general trend is 0.3 RD or less between the first and third trace.

CONFIRMATION:

EXERCISE 1. temperature and humidity

EXERICSE 2. temperature and humidity

Lets for just a moment and look back to the baseline on page 1 WB.

Do we have at least 5 low reference traces (1) on 95.0 RD? Yes we have six.

Do we have two temperature traces that are identical (2)? Yes, the last two are both at 69.8 RD.

Do we have two humidity traces that are identical. Yes, the last two are both printed at 74.8 RD.

(4) Even though the printed data as explained above meets the baseline criteria, there is still another requirement. Relative humidity within the baseline checkset chamber must be in a range between 20 and 70 percent. For the baseline of page 1 WB, the humidity was 35%.

(5) After all the above criteria has been met, the data evaluated, and set up on the CP-223 Computer, 25.0°C on the computer scale must fall between 66.5 and 68.9 RD values on the computer.

b. Since the evaluation of the baseline is the most important step in evaluating the record, we are going to explain it again and in a little more detail. After all, we want you to get a good start in the learning process of this module. Also in a few minutes, you are going to be evaluating baselines, so please study the following information and give it your best shot. Turn to page 2 WB and keep it before you as we explain the baseline process. Take a look at the printed traces of the baseline at the lower right hand corner just above Example 1, Printed Baseline Criteria.

(1) The first signal selected by use of the baseline checkset manual control was low reference. Low reference signals should cause the pen to print on 95.0 RD. If the pen does not print on 95.0 RD, the operator must adjust the REF ADJ control on the Q5. Take note that the first two reference traces were adjusted but not good enough. Starting with the third low reference trace up from the bottom, all the following traces are on 95.0. Thus the low reference traces are printing properly for a valid baseline.

(2) The second signal selected was a temperature signal and the operator identified this trace by placing a T under it.

(3) The third signal selected was humidity and the operator identified it with an H.

Note: The procedures for obtaining the first three traces (Ref. Temp. Hum) as explained in (1), (2), (3) above are performed in this order for each and every baseline.

c. Now lets inspect the traces above the first 3 just explained. After the first three traces have been printed and identified, the baseline checkset selector switch is positioned to AUTOMATIC. In this position, the checkset will automatically switch the transmitted signals through the following cycles; low reference (for 15 seconds), temperature (for 15 seconds), low reference (for 15 seconds), and humidity (for 15 seconds). This swtiching thus causing the printed traces will continue over and over until the operator determines that he has the required number of valid traces (as explained in para b above) and termintes the baseline. In order to obtain the required valid traces, the following must happen:

(1) The equipment must operate in a stable condition to permit at least five low reference traces to print on 95.0 RD without the operator having to adjust. See (A) of Example 1. As you can see we have six.

(2) Between the first and last low reference trace as explained in (1) above, we must have two successive temperature traces that are identical (same RD value). See (B) of Example 1.

(3) Within the good low reference traces, we have three successive humidity traces that follow a general trend and are within 0.3 RD between the first and last trace. See (C) of Example 1.

Note: If the last two humidity traces had been identical (same RD value), we would have used only the last two.

4. BASELINE TERMINATION

When the required traces have been printed, the baseline is terminated. The baseline is always terminated at the top of a low reference following the last usable humidity trace. See (E) of Example 1.

a. The baseline is terminated by placing the Q5 SELECTOR switch to SC position and allowing the pen to print on zero RD for about ½ inch. See (D) of Example 1.

Note: The pen should print on zero before beginning a base line and should print on zero after baseline termination.

b. The baseline level is accomplished by drawing a horizontal line all the way across the chart. This line is always drawn at the top of the last humidity trace. See F Example 1. The level (line) must be parallel to the horizontal lines on the chart. Look at the line from (D) to (E) of Example 1.

c. Using a straight edge, the left edges of the two temperature traces are extended with a straight line drawn about ¼ inch above the level. See (B) and (E) of Example 1.

d. The three humidity traces are extended in the same manner as temperature. This is shown by (C) and (F) of Example 1.

5. BASELINE EVALUATION TASK 2007

After the baseline is terminated, level drawn, and the trend lines drawn as explained above, we are ready to evaluate the data.

a. At the exact time of termination, the dry and wet bulb temperatures are read from the psychrometer located in the base line checkset chamber. These two temperatures are read to the nearest tenth of a degree. Using this information and chart VIII of FM 6-16, the relative humidity in percent can be determined. If you will recall for a moment that you used this same chart and computed relative humidity in module 1. Well we will review the procedures again and let you gain more proficiency. It is most important that the dry bulb temperature and relative humidity values be correct for baseline evaluation.

b. DA Form 4197, Radiosonde Data Sheet is used to record all data from the recorder record. We will explain this form in more detail later. However, for now lets learn how to use the top portion that has been inserted for baseline data as shown in Example 2 of page 2 WB.

c. The basline dry-bulb temperature of 20.0°C and wet-bulb temperature of 10.9°C was recorded in column (4) of the data sheet. Find this information on the data sheet as shown in example 2. The relative humidity determined from this information was 30% and it was recorded in column (6).

d. Now lets see how the baseline temperature was evaluated in example 2. The left edge of the trend line for temperature (at the baseline) was determined to be 69.9 RD. This value is recorded to the right of temperature trend line and just above the level. Notice that a -0.3 correction is applied to the 69.9 value. This correction was determined from the graft in B of example 2 (located just below the baseline traces). Lets talk about this graft for just moment. A calibration test for the Q5 is performed once a month or sometimes more often

by the repairman. This test determines if the Q5 prints where it is suppose to with certain fixed values of input signals. More often then not, there may be some error at certain input frequencies. Thus the calibration correction graft shown in B of example 2 is the results of the calibration test. Notice on the graft for 69.9 RD that the correction is a -0.3. For RD values between 78 and 95, the correction would be +0.0. Thus the evaluation for baseline temperature is recorded as 69.9 - 0.3 = 69.6 = 20.0°C as shown in (A) of example 2.

e. Lets see how the baseline humidity was evaluated. The humidity trend line at the level was determined to be at 78.4 RD. Looking down at the correction graft and at 78.4, we can see that the correction is 0. Thus the humidity is evaluated as (78.4 + 0.0 = 78.4 = 30%). The humidity evaluation is always recorded just below the level and underneath the temperature evaluation. Note: Humidity evaluations are always enclosed in parentheses. See example 2 C for how humidity is evaluated and recorded.

f. Notice on the radiosonde data sheet that the corrected temperature RD value (69.6) is recorded in column (3). The corrected humidity RD value 78.4 is recorded in column (5). This completes the procedures for baseline evaluation except for setting up the evaluated baseline information on the computer. You will learn how to use the computer just as soon as you have gain some practice in evaluating the baseline.

6. Review in How to Determine Relative Humidity for the Baseline. TASK-10Q6

a. Before you begin the practical work in evaluating baselines, lets talk about humidity and be sure that you know how to determine humidity using the dry and wet bulb temperature and chart VIII. One of the several requirements for a valid baseline is that the humidity within the baseline check set chamber must be within a range of 20 to 70%. Stating this further, the humidity must be stable (not changing) but must be within the prescribed range. If the humidity is above 70%, it must be lowered. This is done by placing about 2 tablespoons of Calcium Cloride inside the tray of the chamber. If the humidity is lower than 20%, we can bring it up by placing about one cup of water into the tray.

b. See the instructor at this time and get an extract copy of CHART VIII (Relative Humidity). Lets review how to use this chart. The arguments needed to use the chart are the dry bulb temperature to the nearest tenth of a degree and the wet-bulb depression (difference between dry and wet-bulb temperature) to the nearest tenth of a degree. The chart is entered with dry-bulb temperature along the vertical scale on the left side of the chart and the wet-bulb depression scale located horizontally along the bottom of the chart. The humidity is read to the nearest whole percent. When your located point falls between humidity lines, you must visually interpolate. Use your chart and determine how the two examples below were solved.

Example 1.
Dry = 22.0°C
Wet = 14.0°C
Depression = 8.0°C
Relative Humidity = 40%

Example 2.
Dry = 23.0°CC
Wet = 13.5°C
Depression = 9.5
Relative Humidity = 32%

Do you agree that the humidity is correct for the two example? _____ If you do not agree check with the instructor.

Solve for relative humidity in the four problems below.

Problem 1. Dry bulb = 21.0°C Relative humidity =
Wet bulb = 13.9°C
Depression =

Problem 2. Dry bulb = 17.6°C Relative humidity =
Wet bulb = 9.8°C
Depression =

Problem 3. Dry bulb = 20.5°C Relative humidity =
Wet bulb = 11.4°C
Depression =

Problem 4. Dry bulb = 25.9°C Relative humidity =
Wet bulb = 11.0°C
Depression =

Would the humidity determined in problem four be valid for a bseline? _____

If your answer is no, what should be done? _____

_____

_____

Instructor Check _____

7. Practical Work In Evaluating Baselines.

a. Turn back to page 2 of your workbook. Lets inspect the chart for a moment. There are 100 recorder divisions on the chart. They are numbered every 10 RD and these numbered lines are shaded a little heavier than the others. Notice that the same numbered scale appears every six inches up the chart. Look up the chart to example 2. We evaluated the traces and trend lines to the nearest tenth of a recorder division. We always evaluate the left edge of trace or trend line to determine the RD value. It does take a little calibrating of the eyeballs to read the RD value to an accuracy required. THINK LEFT EDGE--ACCURACY IS IMPORTANT in determining RD values, especially for baseline evaluation.

b. The upper half of page 2 WB includes 2 sample baseline problems that you are to evaluate. You should have the following items of equipment at this time.

One each medium or soft lead pencil.
One each hard (preferable 3H) lead pencil.
One each straight edge with centerline.

If you do not have of these items, see the instructor. Each sample baseline has a portion of the radiosonde data sheet inserted to the left of it. The data sheet has the dry and wet-bulb temperatures for that recorded baseline. You are to evaluate each baseline and fill in columns (3), (5), and (6) of the data sheet. Use the calibration graft below Example 2 for baselines 1 and 2.

Note: The hard lead pencil is used for drawing trend lines and levels. The soft lead pencil is used for writing the information on the record. When you have completed a baseline evaluation and have filled in the data sheet, have the instructor check your work before proceeding.

c. Below is a test to determine how well you understand the baseline procedures. If you have any doubt of how to evaluate the baseline go back and review paragraphs 3 through 4e.

TEST

Answer the following statements true or false.

1. The baseline is drawn at the top of the last humidity trace. _____

2. The temperature trend line is drawn on the left edges of the traces and extended above the baseline. _____

3. The humidity trend line is drawn in the same manner as temperature. _____

4. The left edge of the trend lines at the baseline are evaluated. _____

5. The temperature evaluations is recorded above the baseline. _____

6. The humidity evaluation is always recorded just below the baseline and underneath the temperature evaluation. _____

7. The humidity is enclosed in parentheses. _____

8. The calibration correction is applied to both temperature and humidity for baseline. _____

Instructor Check _____

GO _____ NO GO _____

Note: If you missed any question in the test, consult with the instructor now. Thus be sure you understand all the material before going any further.

d. We hope you did well on the test above and have a good grasp on how the baseline check is accomplished and evaluated. However to be sure that you will have no trouble later in the course lets practice baseline evaluation some more. Turn to page 3 WB. Draw and evaluate baseline number 3, 4, and 5. Be sure to have each baseline evaluation checked by the instructor before proceeding to the next one. We are concerned that you learn to perform this task well and not pick up any bad concepts at this early stage.

8. How To Set Up Baseline Data On The CP 223 Computer Task 2008

a. The final step in determining if a baseline is valid cannot be accomplished until the baseline data is set up on the computer. At this time see the instructor and he will issue a computer to you.

b. The computer is used to determine the validity of the baseline and to convert the recorder division values of temperature traces into degrees Celsius (°C) and the recorder division values of humidity traces into relative humidity in percent.

c. The computer is a type of circular slide rule that is easy to operate. Do not be afraid of it. The computer is much easier to use than a regular slide rule. It consist of three plastic disks fastened together at their centers with a common screw and two knurled knobs. The knurled knobs permit each disk to be rotated independently during the set up of the baseline information. Also attached to the computer is a transparent arm (called a cursor)

with a hairline engraved along its long axis. The cursor hairline is used to aline the graduations of one disk with those of another disk. The hairline also has a scale graduated in degrees Celsius from +40° to -40°.

d. Lets inspect each of the disk on the computer more closely. Look at large disk (base plate) scale. Notice that it has graduations from +60°C to 100°C. The graduations are numbered every 5. The short graduations represent five tenths of a degree. We have to read this scale to the nearest tenth of a degree. The middle disk has a scale that represents recorder divisions. This scale is number every five from 5 to 90. The short graduations represent five tenths of recorder division. We must read this scale to the nearest tenth of a recorder division. The inter most disk represents a family of humidity curves from 10 to 100 percent. This scale is numbered every 10 up to 50 and from 50 to 100 it is number every five. Look all the scales over for a moment. We must set up and read this scale to the nearest whole percent.

e. Lets use a step by step procedure and learn how to set the baseline information for example 1 below on the computer.

Example 1: Baseline Data

$$\frac{69.8 + 0.2 = 70.0 = 30.0°C}{(74.9 + 0.1 = 75.0 = 35\%)}$$

Step 1: Pull the tape back from the front of the two inter most disk and loosen slightly the two knurled knobs. Note: The tape is used to assist the knobs in keeping all disk locked in place after the baseline data is set up.

Step 2: Move the cursor hairline over 30.0°C on the outer disk scale and hold it there.

Step 3: Take your other hand and move the recorder division disk until you have 70.0 RD underneath the hairline. You now should have 30.0°C and 70.0 RD under the hairline.

Step 4: While holding the two outer disk, tighten the small knurled knob firmly and pull the tape down on to the RD disk only. Note: The large knurled knob should be slightly loose. The cursor is free to move now.

Step 5: Move the cursor until you have its hairline over 75.0 RD (for humidity). Hold the hairline firmly over 75.0 RD.

Step 6: With your other hand move the inter most disk (humidity curves) until you have 35% curve under 30.0°C on the cursor scale. Hold the humidity disk firmly at this position and tighten all knobs and push the tape down on all three disk. The cursor is now free to move.

f. The computer should be set up with the example baseline and ready to evaluate a flight. However you want to remember this. We never set up a computer and use it for flight evaluation without rechecking it for correct setting first. So lets recheck your computer setting as follows:

Step 1: Move the cursor hairline to 30.0°C on the outer scale. Is 70.0 RD for temperature under the hiarline? _____ Yes or no _____. If your answer is no you must go back to par e step 1 and reset up all the data.

Step 2: Move the cursor hairline to 75.0 RD for humidity. Is the 35% curve under 30.0°C on the cursor scale? _____ Yes or no _____. If your answer is no, the humidity disk must be reset.

Note: The computer must be set up for each new baseline for each flight. Also the computer must be rechecked after each setting. This is a must.

Have the instructor check your computer at this time.

Instructor Check _____

9. How to Use The Computer.

a. The last check to determine if the baseline is valid is to use the computer and determine what RD value equals 25.0°C. For a valid baseline 25.0°C on the outer scale must fall between 66.5 and 68.9 recorder divisions. Move the cursor over 25.0°C on the outer scale. Read the RD value to nearest tenth under the hairline. What RD value does 25.0°C equal on your computer? 25.0°C = _____

Instructor Check _____

Note: Do not change the computer setting until you are told to.

b. Now that you have the computer properly set, lets use it to evaluate a few levels from a evaluated record. The data from the record has been recorded on the radiosonde data sheet below.

RADIOSONDE DATA
(FM 6-15)

STATION	LOCATION	RELEASE TIME		DATE	HOUR	FLIGHT NO.
			LST			
			GMT			

LEVEL NUMBER	PRESSURE		TEMPERATURE		RELATIVE HUMIDITY	
	CONTACT (1)	MILLIBARS (2)	RECORDER DIVISION (3)	°C (4)	RECORDER DIVISION (5)	% (6)
BASE-LINE CHECK DATA	(INITIAL SETTING)	(INITIAL SETTING)	70.0	DRY 30.0°C WET 19.0°C DEP'N 11.0°C	75.0	35 %
RELEASE DATA				DRY WET DEP'N		
SUR 0			67.0	24.0°C	67.5	50 %
1			64.9	20.2°C	55.0	62
2			63.0	↵	50.0	↵
3			55.0	↵	72.0	↵
4			51.5	↵	75.3	↵
5			48.5	↵	78.0	↵
6			39.8	↵	80.0	↵
7			44.0	↵	75.0	↵
8						

(1) We have determined the temperature and humidity for the first two levels (0 and 1). The 0 level is for surface and level 1 is the first level above surface.

(2) Take your computer and see how we determined the temperature of 24.0°C and the humidity of 50% for level 0.

Step 1: Move the cursor hairline over 67.0 RD for temperature. Read the temperature on the outer scale. You should read approximately 24.0°C.

Step 2: Move the cursor hairline over 67.5 RD for humidity. Look down the cursor scale to 24.0°C and read the humidity from curve disk under 24.0°C. You should read approximately 50%.

(3) In order that you get the idea in using the computer, lets work through level 1 together.

Step 1: Move the cursor hairline over 64.9 RD for temperature. You should read approximately 20.2°C on the outer temperature scale.

Step 2: Move the cursor hairline over 55.0 RD for humidity. Look down the cursor scale to 20.2°C on the cursor scale. You should read approximately 62%.

(4) Solve for temperature and humidity for levels 2 through 7. When finished have your data sheet check.

Radiosonde Data Sheet
Instructor Check _____

10. Practical Exercise in Setting Up Baseline Data on The Computer.

a. It takes some practice in setting the baseline data accurate on the computer. Then to this task is so important in the evaluation of the recorder record. Thus you must be able to evaluate the baseline and set the data on the computer without errors.

(1) Turn to page 2 WB. Set the evaluated data for baseline 1 on your computer. Determine where 25.0°C falls in on the computer. Record this data about center of the chart and just under the baseline as shown on the baseline for the example on page 1 WB. Have your computer setting checked by the instructor.

(2) Set up data for baseline #2 on the computer and determine 25.0°C RD value and record the data in appropriate place on the record.

(3) Turn to page 3 WB. Set up the data for baselines 3, 4, and 5. Determine the 25.0°C RD value for each. Record your data as shown on page 1 WB. Remember. The computer has to be reset for each baseline.

(4) At the top of page 3 WB, there are five problems. They are identified as A, B, C, D, and E. This baseline data is shown only on the radiosonde data sheets. These problems are put in for the purpose of allowing you to become an expert in setting up the computer. When you have baseline E set up on the computer and checked, complete evaluation for levels 2 through 6. For a review before you actually determining the values for level 2, use your computer and check our answers for levels 0 and 1. If you do not agree with the recorded values check with the instructor.

11. This completes this section on how to evaluate the baseline check and set up and use the computer. You may think that we have spent too much time on these tasks. However since knowing how to perform them is so important to evaluating the recorder record, we think the time spent is worthwhile. If you have any doubt about evaluating the baseline or using the computer go back and review the material in this section. When you understand baseline evaluation and how to use the computer, a great amount of the learning in this module has been accomplished.

12. Your objective for this section of instruction is to evaluate levels on the record that have been selected and drawn on the record for you. Later you will learn how to select significant levels on the record and also evaluate them. The evaluation of the baseline, setting in the baseline information on the computer and knowing how to use the computer to determine temperatures and humidities are most important. However, knowing this is not enough if you cannot distinguish between traces and know what they represent on the recorder record. The purpose of the next paragraph is to give you an understanding on how the printed record is accomplished. Turn to page 4 of the workbook and keep it before you as we discuss the following.

a. HOW TO IDENTIFY RECORDER TRACES

Lets recall from module 1 when you studied the makeup of the radiosonde. The bottom of page 4 WB shows a pictorial view of a portion of the commutator bar. The commutator bar is made up of 180 contacts. Each contact contains a conducting segment and a nonconducting segment. Non-conducting segments represent temperature signals. Conducting segments other than multiples of five represent humidity signals up to 130 contacts. Conducting segments in multiples of five represent low reference signals except multiples of 15 starting with 30 which are high reference signals. All the above is true up to 130 contacts.

b. After 130 contacts and up to 180 contacts, the non-conducting segment continue to be temperature signals. However, when the radiosonde reaches a height to cause the pin arm to rest on the 130 contact, the humidity is so low that it is not worthwhile to consider. Thus there are no humidity signals after 130 contacts. Starting with 130 to 180 contacts, the conducting segments are low reference signals except multiples of five which are high reference signals.

c. Take a look at the printed record of the flight on page 4 WB. The surface pressure read from the barometer was 988 millibars. The calibration chart that came with radiosonde indicated the pin arm should be set on 6.5 contacts. The picture indicates that the pin arm is set on approximately 6.5 contacts.

d. When a radiosonde is released, the aneroid cell expands and moves the pin arm across the commutator bar toward decreasing pressure (higher contact numbers). Since the pin arm was set on 6.5 contacts (between 5 and low 10 reference segments) the first low reference signal that is printed on the record should be 10.

e. Take a look at the printed traces. Low reference signals are of a fixed value of 190 pulses per second. If everything is properly adjusted, low reference signals should cause the pen of the recorder to trace at 95.0 recorder divisions. If the operator is in doubt of the number of the first low reference print above surface, he can wait for the first high reference (number 30) and count back down to determine the value of the first low reference. Note: High reference signals cause the pen to print at approximately 97.0 recorder divisions. Check this out on the record on page 4 WB.

f. Since the first low reference above surface has been determined, the contacts can be counted down to surface to see if the pin arm was set properly. It should be apparent to you by now, that a reference signal follows a temperature signal and a temperature signal also follows a reference signal. You must be aware of this in order to distinguish between humidity and temperature traces.

g. Notice on the record that there are 5 temperature traces between two reference traces. There are 4 humidity traces. As you can see temperature precedes a humidity traces and also follows a humidity traces except when a reference trace replaces humidity.

13. Look the traces over closely and distinguish which are temperature and which are humidity. At certain points on the record, you are asked to identify the trace that the arrow points to. Please do so now by circling the correct answer.

a. More will be said about measuring to determine the actual release contact. For now we want you to be able to count contact numbers at levels above surface. The reference contact numbers have been numbered up to 30 contacts (high reference). Number the references for the remainder of the record. Record them to the right as shown in examples.

b. A whole contact number ends at the top of a temperature trace (examples 7.0 through 11.0) visual interpolation is necessary when levels lay between whole contact numbers. For example: The level at 17.5 contacts. The level was drawn and the contacts counted up from the 15th reference. It was determined that the level was approximately half way between 17.0 and 18.0 thus it is at 17.5 contacts.

c. It is very important to be able to read contact numbers to the nearest tenth of a contact. Levels have been drawn on the record at points A through 1. Determine the contact numbers for these points, record them above the levels and left of the temperature trace as shown at 17.5 contacts. When you are finished, have your evaluations checked by the instructor.

14. HOW TO PERFORM SURFACE REFERENCE-TEMPERATURE-HUMIDITY CHECK

Now that you know how to count contacts, distinguish between reference, temperature, and humidity traces, you should have a good idea on how the printed record is accomplished.

a. Lets learn how to determine the temperature and the relative humidity for surface. The purpose of the reference-temperature-humidity check is to make sure that the radiosonde is functioning properly and determine the surface temperature and humidity.

b. After the baseline has been performed, the battery is installed in the radiosonde. The pin arm is set to the contact matching surface pressure. the Radiosonde is then taken to the release point. With the pin arm in the up position, the blue and black test leads are shorted together to cause the low reference signal to be transmitted. The recorder operator positions the Q5 selector switch to signal position and observes the trace, if the pin is not printing on 95.0 recorder divisions, he adjusts the REF. ADJ. The pen must print on 95.0 at a stable condition. After a good reference trace, the test heads are pulled apart and a temperature trace is allowed to print. NOTE: The radiosonde must be allowed to condition (approximately 5 minutes) to the outside atmosphere in order to cause a good stable temperature trace to be printed. After a stable trace for temperature is printed, the black and yellow leads are shorted together and a humidity trace is printed on the record. NOTE: You will set the pin arm, connect the test leads, and perform the ref adj as just explained when you get to module six. For now we want you to learn how to evaluate the printed traces.

c. TURN TO PAGES 5 WB. On this record, the baseline has been drawn and evaluated for you. Take this information and set it on your computer. Do this now. Recheck your computer to see if it is set up correctly. Notice in example 1 (just above the baseline), we have adjusted the low reference trace on 95.0. The next trace was temperature (note how it was identified) so we evaluated it, reading the left edge of the trace to nearest tenth of a recorder division. For temperature, we must always apply a linearity correction (as shown). Then using the computer, we determined this corrected temperature value for surface as 6.1°C. Use the recorder division value for (Ex 1) and see if you read the same value (6.1°C) as we did. The next trace was humidity and identified as A, It was evaluated as 69.5 and this value equals 48% with a surface tamperature of 6.1°C. Notice that we do not apply a correction for linearity to the humidity. Set the humidity recorder division value on your computer and using the surface temperature determine if the humidity in percent is correct. Check example 2 and see if you obtain the same values as we did. Check with the instructor now if you do not understand the procedure.

d. There are four exercises in evaluating the traces for surface on page 5 of the WB. Leave the same baseline information set up on your computer. Evaluate each of the temperature and humidity traces, use the linearity correction graft at bottom of the page for each temperature trace. Determine the temperature and humidity using your computer. Note how and where the information was recorded in the examples. Please record your data the same way for each exercise. Be sure and have the instructor check your work when to told to do so on the workbook.

15. HOW TO EVALUATE SURFACE LEVEL AND DETERMINE SURFACE CONTACT

After the baseline has been performed and determined to be valid, the pin arm is set to the contact number matching surface pressure. The radiosonde is then taken to the release point and the surface check is performed. You just learned how to evaluate the surface data on page 5 WB. We are now ready to learn a new and important task in how to evaluate the surface level.

a. The first level on the record once the radiosonde is released is for surface. TURN TO PAGE 6 WB. The surface level is always drawn at the point on the record where the flight began. This point is where the pen moves of zero recorder divisions. As the pin moves off zero, it causes a 1 to 2 RD (recorder division) horizontal line. The surface level is drawn on top of the print made when the pin moves of zero RD and is drawn parallel with the horizontal lines on the chart. The level is drawn completely across the chart. This shown in EX1 of page 6 WB.

b. After the surface level is drawn, fiducial marks (/T\ and /H\) for temperature and humidity recorder division are drawn. See EX2 and EX3 of page 6 WB. The fiduacial marks are placed at the surface level and at the same RD values as the temperature and humidity traces for the surface checks. Compare the fiducial marks of EX2 and EX3 with the uncorrected RD values for the surface checks shown on the record.

(1) Evaluate the baseline at bottom of page 6 and set the information up on your computer. Use this setting for evaluating the surface temperature and humidity for each of the 4 exercises.

(2) Evaluate the temperature and humidity traces for surface. Use the linearity correction graft at the bottom of the page for all 4 exercise.

(3) Determine surface temperature and humidity for each exercise.

(4) Draw surface level and then draw in the fiducial makes at the levels for each of the four exercises.

16. HOW TO EVALUATE RELEASE CONTACT.

a. The last step for evaluating the surface level is to determine the release contact. This task is very important. The release contact for surface must be determined correctly or otherwise all data from the record used in determining heights will be in error. The operator must not take for granted that the pin arm was set correctly, he must evaluate the surface level contact on the record to be sure that the pin arm was set correctly or if an error exist. In order to determine the surface level release contact, the following steps are taken. TURN BACK TO PAGE 5 WB AND LOOK AT EXERCISE 4 AT TOP OF PAGE.

b. How to determine the number of the first low reference above surface. If for example, the pin arm was supposed to be set at 6.6 contacts, the first low reference printed should be 10. If the operator has any doubt of the number of first low reference, he can wait for the first high reference (30) and count back down on the record. Look at exercise 4. This shows how to determine the number of the first low reference above surface.

c. Once the operator knows the number of the first low reference above surface, he counts the whole contacts down to top of the first temperature trace. Remember whole contacts end at top of temperature traces. This counting down is shown in exercise 4.

d. Using a piece of scratch paper, a measurement of the first full contact (from top of first temperature trace to the top of second) is made. This measurement is made vertically on the chart as shown in exercise 4. The measure is then compared to the distance from the surface level to the top of the first temperature trace. The distance in this example was visually interpolated to be four tenths of a contact. Thus 0.4 from 7.0 (first contact above surface) equals 6.6 contacts. In this example the pin arm was set correctly and thus no error. Later on we will learn what to do when a contact error exists. At present time we want you to learn how to determine the surface release contact from the printed record.

e. Look over the example in the exercise 4 page 5 WB. Turn to page 6 WB. Evaluate the release contact for exercises 1, 2, 3, and 4. NOTE: The evaluated contact value is always recorded just above the level and to the left of the temperature traces. Have the instructor check your surface contact evaluation for each exercise.

17. HOW TO RECORD BASELINE AND SURFACE DATA ON THE RECORD

a. The last step in evaluating the baseline is to record the baseline check data on the left side of the record. This is done after the baseline check performance has been determined to be valid. A stamp is usually provided where appropriate data can be filled in. If a stamp is not available, the following items are entered in the order listed.

(1) The words "BASELINE CHECK" and the local standard time (LST) of the last trace are recorded above the baseline. See stamped information on page 6 and use LST that you drew the baseline.

(2) The code designation (station indicator) of the station is the first item recorded below the baseline. (Station indicator will be MET here at the School.

(3) Date _____ Flight No. _____ (for your record today's data and flight 1).

(4) Temperature Dry _____°C (from R/S data sheet)
Wet _____°C

(5) Baroswitch _____ R/S _____. (From the pressure calibration chart that is packed with radiosonde. For this flight, use Baroswitch number 067128, R/S AN/4(D).)

(6) Operator _____ (Your last name).

(7) Checker _____ (The instructor).

(8) Fill in the baseline information page 6 WB now and return to the next paragraph for further instruction.

b. Certain information for surface release is entered on the record as it was for the baseline. Look at stamped data for the surface level in exercise 4 page 6 WB.

(1) The words SURFACE RELEASE _____ LST is stamped or printed just above the surface level and starting at the second recorder division. Time of release is entered.

(2) PRESSURE _____ CONTACT NO. _____ (pressure read from barometer and pin arm setting before release). This data is also on radiosonde data sheet for the record.

(3) SURFACE TEMPERATURE _____°C (from outside check).

(4) SURFACE HUMIDITY _____% (from outside check).

(5) RELEASE CONTACT NUMBER _____ (the number evaluated on the record).

(6) CONTACT CORRECTION _____ (amount of correcting to apply to evaluated release contact to equal the contact that pin arm was supposed to be set on). For record 6 the contact correction will be 0.

(7) Fill in the surface block on record P6 WB and have instructor check your evaluation. Then return to paragraph 18 for further instruction.

18. How To Evaluate Levels On The Record Above Surface.

a. When the radiosonde becomes airborne it sends weather information back that is printed on the recorder record. The recorder operator (RO) selects points on the record that represent significant weather changes. After a significant change is selected, a level is drawn at this point and completely across the record. The data at the level is then evaluated. For now we want to learn how to evaluate the levels. For the present we will select and draw in the levels for you. Later on you will learn the selection process of placing the levels on the record.

b. Turn to page 1 of the workbook. Keep this sample record before you as we discuss how to evaluate levels.

(1) Look at the level numbers. The levels are numbered starting with 0 for surface and proceeding up the record are numbered in numerical order. The numbers are placed just above the level and to the left of zero recorder division.

(2) The contact number must be determined to the nearest tenth of a contact for each level. The contact value is recorded just above the level and just to the left of the temperature trace. Notice how the contact values were recorded for levels 0 thru 11. NOTE: When a level is placed somewhere between the tops of temperature traces, the contact tenths have to be visually interpolated (such as 17.7 contacts for level 3).

(3) In order to determine the temperature RD value for the level, the left edge of the trace is evaluated where it intersects the level. When a level falls between two temperature traces, the bottom of the trace above the level is connected with a trend line to the top of the trace below the level. The temperature RD value is determine where this trend line crosses the level. When the temperature RD value is determined, it is recorded just above the level and just to the right of the temperature traces.

(4) There are two corrections that are always applied to the temperature RD values for all the levels above surface. The first correction is the linearity correction. It is applied in the same manner as for baseline. Notice by using the graft on the bottom of the page and 67.4 RD for level 1, the correction is +0.2. The second correction for temperature is for frequency drift. Lets see how the frequency drift correction is determined. If you will look up the record on page 1, you will see that not all of the low reference traces started printing on 95 RD. These traces indicate that the operator had to turn the REF ADJ to cause the traces to print on 95 RD. Notice that the amount of corrections to have the trace on 95.0 RD are recorded at the bottom and top of each low reference. For example: At low reference number 10, the correction is +0.7 at the bottom and +0.0 at the top. A frequency drift line is drawn from 95.0 RD at the surface level up to the bottom of the first low reference. For the remainder of the record the frequency drift line is drawn as follows: The top of the first low reference is connected by a line to the bottom of the next low reference.

c. Now lets see how the frequency drift is applied to a level. When a level is drawn on the chart, the frequency drift line for 95 RD is checked at the level. For level 1, the frequency drift at the level is +0.7 and this value is recorded just above the level between 90 and 92 RD. Check with the instructor and he will issue you a frequency drift correction chart to use the remaining time in this module. This chart has the mathematically formula for frequency drift. However, you need not work the formula if you can use the graft. For example in using the drift chart for level 1. See figure 1 and explanation below.

(1) Go down the chart at 67.4 RD, (1) Fig 1 to (2) the diagonal line label 0.7. This 0.7 represents frequency drift at 95.0 RD for the level.

(2) At the point where 67.4 RD and the .7 diagonal line intersect, check the nearest horizontal line on the chart to this point. Follow this horizontal line over to the right. In this example, the correction is +0.5, (3) fig 1.

(3) Thus the correction is +0.5 for 67.4 RD for +0.7 at 95 RD.

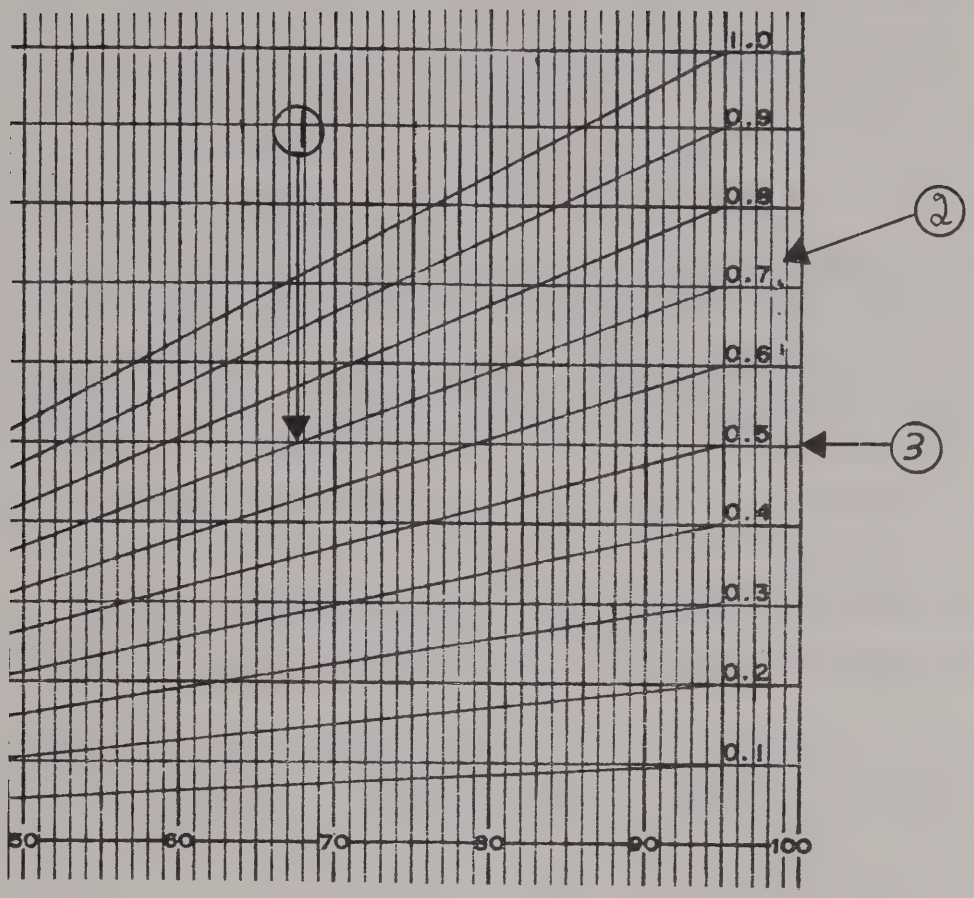

Figure 1. Portion of frequency drift chart.

d. More About Frequency Drift.

(1) The frequency drift line is not drawn to high references. This can be seen at the 30th and 45th references on page 1 WB.

(2) The frequency drift corrections are applied to all temperature RD for levels above surface.

(3) No corrections are applied to humidity RD for levels on the record except when frequency drift for 95.0 at the level exceeds 1.0 RD. Note: For now no corrections will be applied to the levels for humidity. We will explain how to correct the humidity RD later when it becomes necessary.

(4) When the frequency drift line is to the right of 95 RD. The correction is minus (-). However, when the frequency drift line is to the left of 95 RD, the correction is plus (+). Look at the frequency drift of -0.4 for 95 at level number 3. The correction is -0.2 for 59.5 RD. Check this out with your drift chart.

e. Use your drift chart and determine the frequency drift corrections for the following.

Recorder Divisions	Corrections	Drift at 95.0
47.5	= _____	+0.6
33.0	= _____	-0.9
66.0	= _____	-0.6
28.5	= _____	+0.4

Instructor Check _____

e. How to evaluate humidity at the level. If a humidity trace touches the level, you just determine the RD value of the left edge of the trace where it touches the level. The humidity RD value is recorded just below the level and under the temperature recorded data. The recorded humidity RD value is enclosed in parentheses. Remember that we do not apply corrections to humidity evaluations except when frequency drift at 95.0 exceeds 1.0 RD. When a level crosses between two humidity traces, the RD value for humidity is determined by drawing a line connecting the top of the humidity trace below the level to the bottom of the humidity trace just above the level. This procedure is shown at level number 1 on page 1 WB.

f. In summary of how to evaluate levels on the record, the following procedures are used.

(1) Determine the release contact for surface level (0). to the nearest tenth of a contact. Draw fiducial marks /\ and /\ for temperature and humidity at the surface level.

(2) Number the reference traces and record values to right of traces between 98 and 100 RD.

(3) Draw frequency drift line from surface at 95 RD to bottom of first low reference trace. The frequency drift line is drawn for remainder of record from top of lower low reference to bottom of the next low reference on the chart. Corrections for bottom and top of each low reference are determined and recorded below and above each low reference.

(4) Determine the contact to nearest tenth for each level and record value just above the level and to the left of the temperature traces.

(5) Evaluate the left edge of temperature at the level and record value just above the level and to the right of the temperature traces. Apply a linearity correction to the temperature RD. Determine frequency drift at 95 for the level and record this value above the level and between 90 and 92 RD. Then use this value and the frequency drift chart to determine the appropriate correction and apply to the temperature RD value. Total the temperature RD value with the two corrections.

(6) Evaluate humidity trace at the level and record just below level and under the temperature data. Always enclose humidity evaluations in parentheses.

(7) When a temperature trace does not touch a level. The trace above the level is connected to the trace just below the level. The temperature is evaluated where this trend line crosses the level. In a situation where a humidity trace does not touch the level, it is treated in a same manner as for temperature.

(8) Levels are number in numerical sequence starting with 0 for surface.

19. Practical Exericse In Evaluating Levels.

Should you have any problem in evaluating the data or or where to record it refer back to paragraph 18 above and to example record page 1 WB. Turn to page 7 WB. For this record, we have drawn the baseline, selected and drawn all levels. We have also numbered the references, drawn and determined frequency drift at 95 for all levels. Now we want you to do the following:

a. Evaluate the baseline. Set up your computer. Determine where 25.0°C falls in on the computer and record this value at about the center of the chart and under the baseline.

b. Determine surface temperature and humidity and record the data in the manner you learned in previous exercises.

c. Evaluate all the levels that have been drawn on the record. Note: Evaluate each level completely in numerical sequence before proceeding to the next one.

(1) Use the linearity correction graft at bottom of page 7 WB.

(2) Use the frequency drift chart and the recorded frequency drift for 95 RD to correct for temperature.

(3) Remember that after baseline, there are two corrections for temperature but none for humidity (at present time).

(4) Be sure to have your evaluations checked by the instructor when you are told to do so on the record.

d. Turn to page 8 WB. Do the following.

(1) Draw and evaluate the baseline.

(2) Set baseline data up on the computer. Determine and record the 25.0°C evaluation.

(3) Determine and record surface temperature and humidity.

(4) Determine release contact value and record it. Draw in the fiducial marks for surface.

(5) Evaluate and number all levels.

(6) Have the instructor check your evaluations when told to do so on the record.

20. How To Correct for Release Contact Error.

On the previous two records, when you evaluated the release level contact, it was the same value as the contact number that the pin arm should have been set on. Every effort should be made to set the pin arm accurately. However, there is always the possibility for human error. The operator must evaluate the release contact and determine if the pin arm was set correct. He must determine if an error exists and know how to apply a correction. This is important.

a. The contact correction is determined by comparing the evaluated release contact number from the record to the pressure calibration chart contact number for surface pressure. If the contact correction is 0 or ±0.1 contact, it is disregarded. This has been the situation on all previous records that you have evaluated. However, if the contact correction is greater than ±0.1 contact, the contact numbers for all evaluated levels on the recorder record must be corrected by the amount of the contact correction. When the operator determines that a contact correction must be applied, he must also notify the zone wind computer of this fact by announcing the sign and the amount of the correction. Contact discrepancies of 2.0 contact or more cannot be adequately corrected. When this situation exists, the flight should be disregarded and a new release initiated immediately.

b. Turn to page 9 of the workbook and keep it before you as we discuss how to determine a contact correction and how to apply it.

(1) In example 1, the release contact on the record was evaluated in usual manner. The release contact was determined to be 6.3 contacts. However, the release contact should have been 6.6. Therefore a +0.3 contact correction was applied to 6.3 to equal 6.6. Thus, the corrected contact evaluation equals the surface pressure 978 millibars.

(2) The next level above surface at 9.7 also had to have the 0.3 contact correction applied. After the correction is applied, the corrected evaluation of 10.0 is transferred to the data sheet to use determining the level pressure. Thus for this flight every level contact value would have to have a +0.3 contact correction applied.

(3) In example 2, the release contact was measured and determined to be 6.0 contacts. For this example, the pin arm should have been set on 5.6 contacts. Therefore the release level contact is evaluated as 6.0 - 0.4 = 5.6. If this was a complete flight a -0.4 contact correction would have to be applied to all levels.

c. On pge 9 WB above the two examples, there are three problems. Determine the release contact, amount of correction and apply the correction. Evaluate the drawn levels above surface for contact numbers for each of the exercisea and apply the appropriate corrections. Have your work checked by the instructor after each problem is completed.

21. Turn To Page 10 WB. You should do the following.

a. Evaluate the base line. Set up the baseline data information on your computer. Fill in data in columns (3), (5), and (6) of the portion of data sheet shown on the record.

b. Determine and record the surface temperature and humidity.

c. Evaluate the surface level and apply a contact correction if an error in release contact does exist. Draw the fiducial marks for temperature and humidity at surface.

d. Evaluate all levels above surface and apply the appropriate corrections.

Note: As you evaluate the record and come to an instructor check point, be sure to have the instructor check and initial before proceeding further.

SECTION III

22. HOW TO COMPLETE THE RADIOSONDE DATA SHEET

a. When the RO evaluates the recorder record, he or she is actually picking out significant changes of weather that occurred in the atmosphere during the sounding. This data evaluated on the record must be transferred to the Radiosonde DATA SHEET (DA FORM 4197). Once the data from the record has been placed on the data sheet, it is further evaluated for the actual pressures, temperatures, and humidities. When the significant level data is completely evaluated, it is used by the Temperature-Density-plotter to plot the Altitude-pressure-Density chart. You will learn this task in another module. For this section, we want you to learn how to complete the evaluation of the radiosonde data sheet.

b. Your objective for this section is to transfer the data from the recorder record to the data sheet and evaluate for pressure, temperature, and humidity.

(1) Turn back to page 1 of the workbook as we discuss how to complete the radiosonde data sheet below. The baseline data on the data sheet was taken from the record. The outside surface check for temperature and humidity on the record is recorded on 0 level for surface. Columns (1), (3), and (5) are taken directly from the record. Notice that we have 12 levels (0 through 11) on the record and the same number on the data sheet. Column 1 includes the evaluated contact for each level. If we had a contact correction column (1) would include the corrected contact evaluation. The same holds true for column (3) which includes the corrected temperature evaluations.

RADIOSONDE DATA
(FM 6-15)

STATION	LOCATION	RELEASE TIME		DATE	HOUR	FLIGHT NO.
MET	FORT SILL, OKLA		LST	8 AUG 79	0810	1
			GMT	8 AUG 79	1410	

LEVEL NUMBER	PRESSURE		TEMPERATURE		RELATIVE HUMIDITY	
	CONTACT (1)	MILLIBARS (2)	RECORDER DIVISION (3)	°C (4)	RECORDER DIVISION (5)	% (6)
BASE-LINE CHECK DATA	(INITIAL SETTING) 7.3	(INITIAL SETTING) 980	70.0	DRY 30.0°C WET 19.0°C DEP'N 11.0°C	74.9	35%
RELEASE DATA	7.3	980		DRY WET DEP'N		
SUR 0		980	65.6	21.5°C	42.0	71%
1	10.0	947	68.1	↳	57.9	↳
2	13.0	907	67.6	↳	75.9	↳
3	17.7	850	59.5	↳	75.9	↳
4	22.0	↳	52.9	↳	75.7	↳
5	26.0	↳	43.5	↳	70.0	↳
6	29.0	↳	39.7	↳	65.0	↳
7	31.3	700	37.0	↳	81.5	↳
8	33.0	↳	35.0	↳	81.5	↳
9	36.6	↳	35.0	↳	81.5	↳
10	40.8	↳	40.0	↳	81.3	↳
11	50.0	↳	30.0	↳	81.3	↳
26						

DA FORM 1 FEB 74 4197 REPLACES DA FORM 6-43, 1 MAR 62, WHICH WILL BE USED.

Instructor Check _____

(2) Lets learn how to determine pressures in millibars from contact values in order to complete column (2) on the data sheet. At this time see the instructor and obtain the following.

1 each Pressure Contact Conversion Chart
1 each Pressure Calibration Chart AB33CC 810-4

You should keep the conversion chart for the remainder of this module training. However, you should return the calibration chart to the instructor upon completion of the data sheet above. In using these two charts for determining pressure for contacts, you do the following:

Example 1. What is the pressure for 12.2 contacts: The pressure on the calibration chart is for whole contact numbers. 12.2 lays between 12.0 and 13.0 contacts.

From the pressure calibration chart 12.0 = 919.8 MB
13.0 = 907.3 MB
Difference 12.5

We now have two arguments in which we can use the computation sheet (.2 contact, the portion of contact between 12.0 and 13.0 and 12.5 millibars the difference of the two whole contact pressures). With these two arguments use the computation sheet.

(a) Go to 0.2 in left column and across to the column heading of 12.5.

(b) The answer is 2.5.

PRESSURE-CONTACT CONVERSION

PRESSURE MILLIBARS

Contact Tenths	17.0	16.5	16.0	15.5	15.0	14.5	14.0	13.5	13.0	12.5	12.0
0.1	1.7	1.7	1.6	1.6	1.5	1.5	1.4	1.4	1.3	1.3	1.2
0.2	3.4	3.3	3.2	3.1	3.0	2.9	2.8	2.7	2.6	2.5	2.4
0.3	5.1	5.0	4.8	4.7	4.5	4.4	4.2	4.1	3.9	3.8	3.6
0.4	6.8	6.6	6.4	6.2	6.0	5.8	5.6	5.4	5.2	5.0	4.8
0.5	8.5	8.3	8.0	7.8	7.5	7.3	7.0	6.8	6.5	6.3	6.0
0.6	10.2	9.9	9.6	9.3	9.0	8.7	8.4	8.1	7.8	7.5	7.2
0.7	11.9	11.6	11.2	10.9	10.5	10.2	9.8	9.5	9.1	8.8	8.4
0.8	13.6	13.2	12.8	12.4	12.0	11.6	11.2	10.8	10.4	10.0	9.6
0.9	15.3	14.9	14.4	14.1	13.5	13.1	12.6	12.2	11.7	11.3	10.8

PRESSURE MILLIBARS

Contact Tenths	11.5	11.0	10.5	10.0	9.5	9.0	8.5	8.0	7.5	7.0	6.5
0.1	1.2	1.1	1.1	1.0	1.0	.9	.9	.8	.8	.7	.7
0.2	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3
0.3	3.4	3.3	3.2	3.0	2.9	2.7	2.6	2.4	2.3	2.1	2.0
0.4	4.6	4.4	4.2	4.0	3.8	3.6	3.4	3.2	3.0	2.8	2.6
0.5	5.8	5.5	5.3	5.0	4.8	4.5	4.3	4.0	3.8	3.5	3.3
0.6	6.9	6.6	6.3	6.0	5.8	5.4	5.1	4.8	4.5	4.2	3.9
0.7	8.1	7.7	7.4	7.0	6.7	6.3	6.0	5.6	5.3	4.9	4.6
0.8	9.2	8.8	8.4	8.0	7.6	7.2	6.8	6.4	6.0	5.6	5.2
0.9	10.4	9.9	9.5	9.0	8.6	8.4	7.7	7.2	6.8	6.3	5.9

(c) 12.0 contact pressure is 919.8
$\underline{- 2.5}$
917.3 rounded off to 917

(3) Example 2. What is the pressure for 19.5 contacts.

(a) 19.0 = 835.8 mb
20.0 = $\underline{824.3}$ mb
difference = 11.5

(b) Go to 0.5 contact tenths on the computation sheet and across to column headed by 11.5, the answer is 5.8.

(c) 19.0 = 835.8 mb
$\underline{- 5.8}$
19.5 contacts = 830 mb

(4) Use the two charts and determine the pressures for the remaining level contacts on the data sheet.

(5) Set up the baseline line data on your computer and complete columns (4) and (6) of the data sheet. Note: When you have completed the data sheet have it checked by the instructor.

c. Use the blank radiosonde sheet below, the same pressure calibration chart and your computer record all the appropriate data from record on page 10 of the workbook. Evaluate the data for all levels and when you have completed the data sheet have your evaluations check by the instructor. Note: Do not forget to reset your computer with the baseline data for record 10.

RADIOSONDE DATA (FM 6-15) FOR PAGE 10 WORK BOOK

STATION	LOCATION	RELEASE TIME		DATE	HOUR	FLIGHT NO.
			LST			
			GMT			

LEVEL NUMBER	PRESSURE		TEMPERATURE		RELATIVE HUMIDITY	
	CONTACT (1)	MILLIBARS (2)	RECORDER DIVISION (3)	°C (4)	RECORDER DIVISION (5)	% (6)
BASE-LINE CHECK DATA	(INITIAL SETTING)	(INITIAL SETTING)		DRY WET DEP'N		
RELEASE DATA				DRY WET DEP'N		
SUR 0						
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Instructor Check _____

23. How To Select Significant Levels On The Recorder Record

a. To evaluate the record with the degree of accuracy required and to produce data as quickly as possible six rules have been established. These rules permit the RO to pick out and evaluate significant atmospheric changes. You should have an understanding by now that the purpose of evaluating the recorder record is to obtain data for use in plotting a (Altitude-Pressure-Density) chart. You will learn how to plot this chart in module 3. Now that you have an understanding in how to evaluate levels, lets learn how select significant points on the record, draw levels at these points and evaluate the levels.

b. The six rules that specify the points to draw significant levels are as follows:

Rule 1. The surface level.

Rule 2. At certain mandatory pressure levels.

Rule 3. At each point of significant temperature change.

Rule 4. At each point where a relative humidity trace deviates from the humidity line by 10 percent or more.

Rule 5. The beginning of, the end of, and within any layer in which the temperature and/or humidity data are considered missing.

Rule 6. Level at termination of flight.

c. For the present time, lets consider the first three of these rules and learn how to use them. Later we will use the remaining three rules. Turn to page 11 of the workbook as we discuss how to use Rules 1, 2, and 3.

(1) Of course the first level drawn on the record, after the flight of the radiosonde begins, is for surface. The rule (1) for drawing this level is that it is always drawn at the point where the recorder pen leaves zero recorder divisions at time of release. When the radiosonde is released and all switches are placed in proper position, the Q5 pen moves off of the zero RD. As the pen leaves the zero position it will cause a horizontal trace (tail) of one to two recorder divisions to be printed on the chart. The level is always drawn on this tail of the trace from zero RD. Note: As the pen moves over from zero RD, it might start printing a temperature trace or a humidity trace or a reference trace. Which trace the Q5 pen prints depends on where the pin arm of the radiosonde was setting at the time of release. In fact the pen might not print anything at time of release because of poor tracking off surface of the rawin set or due to an inexperienced operator at the rawin set.

(2) Since you already know how to evaluate the surface level, we will not spend any more time talking about rule 1.

d. Now lets learn how to use rule 2 for mandatory pressure levels. One of the missions of the artillery met section is to furnish weather data to AWS (Air Weather Service). When we are required to give data to AWS, we must evaluate certain mandatory pressure levels. Rule 2 covers these mandatory pressure levels which are placed at 1000 (when applicable), 850, 700, 500, 400, 300, 250, 200, 150, 100, 50, 30, and 10 millibars. The procedure is for the RO to use the pressure calibration chart for the radiosonde for that flight and determine the contact numbers for the mandatory pressure levels. Using the mandatory pressure contact numbers, it is a simple procedure to place the levels on the record. Turn to page 11 WB. As you can see on this record, we have only two mandatory levels (for 850 and 700 millibars). Since the surface pressure was 968 millibars, the 1000 millibar mandatory level did not apply to this flight. Also the end of requirement for this flight was for 525 millibars at 50 contacts. Thus you can see that on the record why we had to consider only two mandatory levels at 17.7 and 31.0 contacts.

Note: In most cases during the training in this module, you will have only two mandatory levels (850 and 700 millibars). However if the end of requirement is above 500 millibars, then there will be more than two mandatory levels.

e. Rule 3. Place a level at each point of significant temperature change. In order to get the levels at the right points on the record for significant temperature changes, we use trend lines. First lets find out what we mean by trend lines.

(1) Lay the centerline of your straight edge on the temperature fiducial mark at surface and along the left edge of the temperature traces as shown by the line (EX1) . As you can see the first 4 temperature traces indicate that the actual temperature is getting colder as the radiosonde went higher. However, after the fourth trace, the traces begin to deviate from the line. These traces (between level 1 and 2) indicate that the air was getting warmer as the radiosonde went aloft. Thus we can say the atmosphere was trending toward colder temperature from surface up to level 1. Therefore the trend line (1) from surface and along the left edges of the traces indicates a trend of the temperature.

(2) At the point where the temperature traces appear to deviate from trend line (1) we placed a check mark (✓). We then drew trend line (2). Thus this trend line indicates a layer of air that gets warm aloft. This is really an inversion layer. Trend line (2) was drawn on the left edge of the traces and extended down far enough to intersect trend line (1).

(3) Level 1 was drawn on the record where the two trend lines intersected.

(4) Level 2 was drawn where trend line (2) and (3) intersected.

(5) As the RO selects and evaluates the levels, he must not forget to place the mandatory level for 850 millibars at 17.7 contacts.

(6) Check the remaining portion of this record out by laying the centerline of your straight edge on the temperature traces and from level to level. As you can see by our trend lines that extend from level to level, the temperature traces do not deviate from them.

f. Significant temperature change (STC). Lets talk more about what is meant by a significant temperature change. The two trend line used to select level 1 extend further apart as they proceed up the record. The shaded area at (EX1) indicates this. Notice at the top of this shaded area line (1) at 58.0 RD equals 9.1°C and line (2) on 60.0 RD equals 12.0°C. Thus there is more than 1°C difference between the two points so this makes this area of change significant. Remember a level is always placed at the point of STC. Perhaps we can say this a different way and make it a little more clear. Once a general trend of the temperature traces has been established (like from surface up through 10.0 contacts) and if the traces deviate from that trend line by 1°C or more, the change is significant and the data must be evaluated. The level is placed at the point where the deviation started.

g. Turn to page 12 WB. This is another example record of how to select levels using the three rules explained above. Look this record over closely. Note where we drew the mandatory level 850 mb for 17.3 contacts. Since it must be between 17.0 and 18.0 contacts, we had to visually interpolate to place it at 17.3 contacts. Pay particular attention to how we drew the trend lines for placing levels for significant temperature changes.

(1) The layer of air from surface to level 1 is an inversion layer. From level 1 to level 2 (mandatory level) the air gets colder. Notice that the temperature from level 1 to level 3 continues to decrease at the same rate.

(2) Check the area from level 3 to level 5. In this area the air gets colder but not at the same rate. By drawing the trend lines, we determined where the decrease rate changed and also determined that it was a significant change. Thus the reason for level 4.

(3) Note the area between levels 5 and 7. In this area, the temperature did not increase or decrease. When a layer of air temperature does not change it is called an isothermal layer. It is not important to identify layers of air such as isotherms and inversions. However, it is most important to be able to select points of significant change, draw and evaluate levels at these points.

h. Turn back to page 10 WB. You evaluated this record after we had selected the levels. To give you another idea in how easy it is to select levels note the check marks on the levels and just to the right of the temperature traces. We selected those points for the check marks by using the center line of the straight edge on the trending traces and noting where the trend changed to another direction. The check marks were placed at these points. At this time do the following:

(1) Place the centerline of your straight edge on the traces from level to level. Do you see why we placed the check marks where we did for drawing the levels?

(2) Now take your straight edge and draw a line from the temperature evaluation at one level to the next level temperature evaluation. Do this all the way up the record. Your line should be practically on the left edge of the traces all the way up the record.

Note: Have your trending check by the instructor.

24. Practical Exercise. Turn to page 13 WB.

a. Please do the following:

(1) Draw and evaluate the surface level.

(2) Draw trend lines and select significant temperature changes. Draw the levels for STC's.

(3) Draw in the mandatory levels.

(4) Note: Number the levels and evaluate each level for contact number only. Have your selections and evaluations checked by instructor where indicated on the chart.

b. Turn to page 14 WB. You are to do the following on this record.

(1) Evaluate the baseline and set up your computer. Complete R/S data sheet columns at top of chart.

(2) Determine surface temperature and humidity.

(3) Select and evaluate completely all levels.

(4) Apply all corrections when appropriate.

Note: As you select and draw a level, evaluate it completely before selecting the next level up the chart. You should keep in mind that under normal operating conditions during a flight the chart is feeding out of the radiosonde recorder. Thus the RO evaluates the record as the data feeds out and making sure that all evaluations are completed as he proceeds up the chart.

c. Turn to page 15 WB. Before you start the evaluation of this record see the instructor and obtain a blank copy of the Radiosonde Data Sheet DA Form 4197. As you evaluate the record on page 15 WB fill out and evaluate all columns of the data sheet. When you are satisfied that the record evaluation is complete up to a point, then complete the data sheet up to that point.

(1) The baseline temperature (wet and dry) is recorded in baseline information.

(2) Surface pressure and the pin arm contact setting before release is recorded in the surface information block.

(3) See the instructor and obtain the pressure calibration chart labeled AB33CC, 810-3. You cannot use any other calibration chart in the evaluation this flight.

(4) You are to do the following on this record.

(a) Evaluate the baseline and set up your computer. (Note: Check your work and strive for accuracy.)

(b) Determine surface temperature and humidity.

(c) Evaluate surface level for release contact and fiducial marks. Note: If you have a contact correction, see the instructor before evaluating any further, he will explain how to place mandatory levels when a contact correction exist.

(d) Select and evaluate all levels. Apply the appropriate corrections. When you have the record and data sheet completed have them checked by the instructor.

25. Points To Remember in Evaluating Recorder Record.

Turn to page 16 WB. Keep this page of examples before you as we discuss some important concepts of record evaluation. Some of these points will be new to you, while others will be a review.

a. Place levels for STC where trend lines intersect. See example 1, points (A) .

b. When a level is placed between two temperature traces for any reason, to evaluate the temperature for the level, connect the trace above the level to the trace below the level. Read the temperature RD where the left edge of connecting line crosses the level. See point (B) of example one.

c. When a level falls between two humidity traces, connect the trace above the level to the trace below. Read the left edge of connecting line at the level. See point (C) of example 1.

d. The fiducial marks for temperature and humidity at the surface level must be drawn at the same recorder division value as the surface (outside check) traces. See point (D) example 1.

e. When a humidity trace appears on one side of a level and none on the other side, the evaluation at the level is accomplished by trending the one trace. See Example 2 Point (A) .

26. HOW TO USE RULE 4 (the humidity rule).

a. Up to this time you have been evaluating the record for mandatory levels and for significant temperature changes. On these sample records, the humidity started out very low and followed this same general trend all the way up the record. This usually does not happen. The humidity may increase in area or decrease. As you know, when the radiosonde goes into a cloud, the humidity will be high (cause traces at lower RD value). Then too, if the layer of air is dry, the humidity is going to be low, thus causing humidity traces to print at high RD values.

b. Rule 4 states that a level must be placed at the widest point where humidity deviates from the humidity line by 10 percent or more. Now this you must remember. The RO always determines that the mandatory and STC reasons have been checked and levels evaluated before he looks for a 10 percent deviation (Rule 4).

c. Example three, on pge 16 WB will show when and how to use Rule 4. The baseline data for setting your computer is printed just above the surface level for example three. Use this data and set it up on your computer now. Remember to recheck the computer to be sure that it is correctly set. Now for the procedures in evaluating a record. First draw and evaluate the surface level. Second place a level at the first mandatory contact or STC whichever comes first. The next thing we do after we have two levels establish is look for any more significant temperature changes between the two levels that might have been missed. Thus we have surface level and the mandatory at 16.5 contacts. Then we drew a temperature trend line (see the line labeled (1) from surface up to the temperature trace for the level at 16.5 contacts. Notice that the trend line follows along the traces. Therefore no more STC exist in this area. So

we are now ready to check to see if Rule 4 applies. In order to determine if we have a ten percent or more deviation in humidity, we do the following:

(1) Draw a humidity line from surface to the upper level (see line label (2)).

(2) We check the widest point of deviation from the line (2) to see if it is 10% or more. Thus this is more or less a trial level.

(3) To determine humidity we must know the temperature at this trial level. See point (A) . Use your computer and check our example.

(4) With the temperature in °C, we determine humidity in percent at the trace. See point (B) .

(5) Next we determine the humidity in percent for the trial level at the humidity line (2) . See point (C) . As you can see the humidity is 58% at point (B) and 21% at point (C) . Therefore a level should be placed here and evaluated in same manner as other levels.

Note: Once a ten percent deviation is determined and a level has been placed and evaluated, line of deviation (2) cannot be used anymore. A new line (3) from surface to level above must be established. Lets state this a different way. Lines of humidity are drawn from level to level (not across a level). Once a level for 10% deviation has been drawn, new lines between levels are drawn and check for deviations.

d. Lets inspect the record above the mandatory level at 16.5 contacts. As you can see the humidity is changing back and forth across the record. But we must look for significant temperature changes or mandatory levels before using rule 4 for 10 percent humidity deviations. Many times STC levels and mandatory levels will take care of the changing humidity. Note how we evaluated the record from 16.5 contacts up to 31.5 contacts. This is the usual procedure.

e. See how well you can do on your own. Evaulate the record completely from 31.5 contacts to include end of requirement at 50.0 contacts. When finished have your work checked by the instructor.

27. Humidity Deviations.

You should be aware that the humidity line bwtween levels does not have to be real close or follow right on the traces. In fact it all depends on where the humidity traces are printing on the chart whether or not we have a significant change of ten percent. For example: When the humidity is printing on the left side of the chart, from 5 to 25 RD, it may take as much as 14 RD deviation to make a ten percent difference. From 40 to 60 RD, it takes around 15 RD deviation to make a 10 percent difference. However, as the traces print over to the right side of the chart, it takes much less to make a significant deviation. In fact from 75 to 82 RD (low percent humidity) a deviation 2 to 4 RD may cause the RO to have to place a level for 10 percent deviation. You will understand this more as you practice record evaluation. The experienced operator can usually tell if a ten percent level should be placed without using the computer.

28. Practical Exercise.

Turn to page 17 WB. For this record you will have to use all of the five rules that you have learned up to now. Also you must apply all appropriate corrections. Evaluate the record through 55.0 contacts. For this record, there will be 3 mandatory levels. At certain places on the record, it calls for an instructor check. Be sure to get the instructor check before proceeding above that point.

29. Missing Data (Rule 5).

There are times when data may not be printed on the recorder record. This can be caused for several reasons, such as poor signals from the radiosonde or failure in the receiving equipment. When data is considered missing and provided there is not enough missing to warrant aborting the flight, rule 5 must be applied. This rule simply stated says that a level must

be placed at the beginning, at the end of, and within any layer in which the temperature and humidity are missing.

a. Now lets determine when we can ignore a missing data area and not use rule 5. Turn to page 18 WB. This record will show how to handle missing data. Look at example one.

(1) First we draw short trial levels at top and bottom of the missing data area. The trial level at the bottom is placed at the top of the last good temperature trace. The trial level at the top of missing data is placed at the bottom of the first good temperature trace following missing data. Note this in example one.

(2) Project a line by trending the temperature trace at lower trial level to upper trial level.

(3) Project a line by trending the temperature trace at upper trial level to the lower trial level. Note these dash trend lines in example one.

(4) If the difference between two trend lines (you can use the area at the top or bottom trial level but must use the one of least difference) is 1°C or less, the data is classified as not missing. The missing data is ignored and the record is evaluated as previously explained using the other rules.

b. When missing data exceeds the limits as explained above, we must apply rule 5. Lets see how this works in Example 2. By treading the trace above missing data down and treading the trace at the bottom of missing data up, we found that the least difference in the two tread lines to be more than 1°C. Thus this area on the record must be evaluated as missing data using rule 5.

c. Once an area on the record is classed as missing data, the following must be done:

(1) A level is placed at the bottom of missing data and this level must be placed at the top of the last good temperature trace.

(2) A level must be placed within missing data (usually about the center of MD area). The contact number is evaluated as XX. The temperature is evaluated as XXX and humidity as (XX).

(3) A level is placed at the top of MD and this level must be at the bottom of the first good temperature following MD.

d. In order to determine the number of the first reference above missing data, the following is done:

(1) A measurement on scratch paper of the distance between the last two references before MD begin is made. See the 35th and 40th reference. This distance is used to mark off up the record. As can be seen in this example, the 45 reference is the only one missing and the first reference above MD had to be number 50.

e. The contact number for the level at top of missing data is determined in the same manner as the surface release level once the RO knows the number of the first reference above this point.

30. When and How to Correct Humidity Record Divisions.

a. The only time corrections are applied to humidity recorder division is when the frequency drift for 95 RD at the level exceeds 1.0 RD. Thus when frequency drift for 95 RD is 1.1 RD or greater, the humidity is corrected in the same manner as the temperature RD. See example 3 of page 18 WB. The frequency drift at 95 RD for level 10 is a +1.3. Thus we must apply corrections to the humidity recorder divisions.

b. Since the frequency drift chart has corrections only up to 1.0, the RO has to do the following.

(1) Determine what the correction is for 1.0 at the recorder division value.

(2) Determine what the correction is for the amount at 95 over 1.0 for the recorder division value.

(3) Add the values obtained in (1) and (2) for the total correction.

c. For example: How to determine the corrections using the chart for level 10 in example three.

(1) The frequency drift for 95 RD is a +1.3.

(2) The temperature RD value is 35.5. Using the chart the correction 35.5 for 1.0 is 0.4. Also for 35.5 for 0.3 (amount over 1.0 at 95) is 0.1. The total frequency drift correction for 35.5 at 1.3 is +0.4 + 0.1 = +0.5.

(3) In determining the frequency drift correction for humidity value of 76.7 RD for 1.3 at 95, do the following: Use the drift chart. 76.7 at 1.0 the correction is 0.8. 76.7 at 0.3 the correction is 0.2. The total frequency drift correction for 76.7 at a +1.3 for 95 is 1.0. Note: When humidity values are corrected for frequency drift, a linearity correction is also applied. Notice that for level 11, the total frequency drift was only a -0.4, therefore no corrections for humidity. However, for the last level at 65.0 contacts, the frequency drift was -1.9 for 95 RD. Use the frequency drift chart at top of the page and check our corrections for the temperature and humidity. If you do not understand how to determine corrections see the instructor.

31. Practical Exercise in Using Rule 5 and Correction Data When Frequency Drift Exceeds 1.0 RD at 95 Recorder Divisions.

Turn to page 19 WB. Use the data for baseline as shown on the radiosonde data sheet and evaluate this record up to and including 50.0 contacts. Have your evaluations checked by the instructor when indicated on the record.

32. How to Determine Contact Numbers From the Pressure Calibration Chart.

So far in this module, we have been giving you the contact number for which the pin arm should be set before release. Also we have been determining the contact numbers for the mandatory levels for you. However, from now on you will have to perform these tasks.

a. You have already learned how to determine pressure from the charts when you have the contact number. Determining contact numbers when you know the pressure is easy but somewhat in reverse order. You should have the following two documents. If not see the instructor.

(1) Pressure Calibration Chart AB33CC 810-4.

(2) Pressure-Contact Conversion Chart AB33CC HO-6.

b. Now lets learn how to determine the contact number for a given pressure. For example: What is the contact number for a surface pressure of 987 millibars.

(1) Using the calibration chart, we see that 987 is between the pressure 996.3 for 6.0 contacts and 983.3 for 7.0 contacts. Thus we can say that 987 is bracketed by these two given contact pressures.

(2) Therefore we can solve for the contact numbers for 987 as follows:

(a)
6.0 = 996.3
7.0 = 983.3
Difference = 13.0

(b)
6.0 = 996.3
Sur. press. = 987.0
Difference = 9.3

(3) Using the two arguments obtained above and the conversion chart solve as follows. Find column heading of 13.0 and go down that column and find the closes value to 9.3. In this case 9.1. Look across from 9.1 to the left most column (contact tenth) to 0.7. The surface contact will be 6.0 + 0.7 = 6.7.

6.0 = 996.3
6.7 = 987.0
7.0 = 983.3

c. Use the two charts and determine the contact numbers for the following surface pressures.

(1) 985 mb = _____ contacts

(2) 975 mb = _____ contacts

(3) 999 mb = _____ contacts

(4) 965 mb = _____ contacts

Instructor check _____

d. Determine the contact numbers for the following mandatory pressure levels.

1000 mb = _____ contacts

850 mb = _____ contacts

700 mb = _____ contacts

500 mb = _____ contacts

Instructor check _____

e. How to place mandatory levels when a contact error exist. When the pin arm of the radiosonde has been set in error, it creates a small problem in the placement of the mandatory levels. However, the problem can be taken care of easily, if the operator understands what must be done. Turn to page 20 WB. Keep this page before you for the following discussion. Before the flight was released, the two mandatory level pressures of 850 and 700 millibars were determined that they should be placed at 17.7 and 31.3 contacts. However, after release of the radiosonde, the operator determined that a -0.3 contact correction had to be applied to all levels. If the mandatory levels were placed at the original contact numbers, they would not be at the correct pressures after the applied contact correction. Thus when we have a contact correction, we have to do the following.

(1) The contact correction for release is applied to all mandatory contact numbers but using opposite sign. See example 1.

(2) The levels are placed at the new determined contacts. Example 2.

(3) When the levels are placed at the new determined contacts and the corrections applied, they will be at the exact mandatory pressures. Examples A and B. Note: How the contact corrections was applied to all levels. Also be sure you understand how to take care of the placement of mandatory levels when a release contact error exists.

33. Practical Exercise.

Turn to page 21 WB. Use the data on the radiosonde data sheet below. Determine what the contact setting for surface with the given surface pressure and pressure calibration chart 810-2. Note: See the instructor and obtain this pressure chart.

a. Evaluate the baseline and set up data on the computer. Perform and record the 25.0°C check.

b. Perform the surface check.

c. Select and evaluate all levels. Don't forget the mandatory levels. Watch for contact correction and apply to all levels.

d. Use the pressure calibration chart and computer and complete all columns of the data sheet for all levels.

FOR PAGE 21 WORKBOOK — RADIOSONDE DATA (FM 6-15) — USE PRESS. CAL. CHART 810-2

STATION	LOCATION	RELEASE TIME	DATE	HOUR	FLIGHT NO.
MET	FORT SILL, OKLA	LST / GMT			

LEVEL NUMBER	PRESSURE: CONTACT (1)	PRESSURE: MILLIBARS (2)	TEMPERATURE: RECORDER DIVISION (3)	TEMPERATURE: °C (4)	RELATIVE HUMIDITY: RECORDER DIVISION (5)	RELATIVE HUMIDITY: % (6)
BASE-LINE CHECK DATA	(INITIAL SETTING) ✓	(INITIAL SETTING) 990	✓	DRY 33.3°C; WET 21.3°C; DEP'N	✓	✓
RELEASE DATA	✓	990		DRY / WET / DEP'N		
SUR 0		990	✓	✓	✓	✓
1	✓	✓				
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
26						

DA FORM 1 FEB 74 4197 — REPLACES DA FORM 6-43, 1 MAR 62, WHICH WILL BE USED.

Instructor Check _____

34. The radiosonde data sheet for flight 1a is located below. Use the data on the sheet and evaluate the record on page 22 WB. When you have completed this record evaluation, transfer the data from record to the data sheet and complete data sheet evaluation.

FOR FLT. 1a PAGE 22 WB

RADIOSONDE DATA (FM 6-15) USE PRESS CHART NO1 P.29 WB

STATION	LOCATION	RELEASE TIME	DATE	HOUR	FLIGHT NO.
MET	FORT SILL, OKLA	LST / GMT			1a

LEVEL NUMBER	PRESSURE		TEMPERATURE		RELATIVE HUMIDITY	
	CONTACT (1)	MILLIBARS (2)	RECORDER DIVISION (3)	°C (4)	RECORDER DIVISION (5)	% (6)
BASE-LINE CHECK DATA	(INITIAL SETTING) 6.4	(INITIAL SETTING) 989		DRY 21.0 °C WET 11.8 °C DEP'N		
RELEASE DATA		989		DRY WET DEP'N		
SUR 0		989				
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
26						

DA FORM 1 FEB 74 4197 REPLACES DA FORM 6-43, 1 MAR 62, WHICH WILL BE USED.

Instructor Check _____

35. The radiosonde data sheet for flight 2a is located below. Use the data on the sheet and evaluate the record on page 23 WB. When you have completed the record on page 23 WB transfer the data from record to the data sheet and complete data sheet evaluation.

FOR RECORD ON PAGE 23 WB

RADIOSONDE DATA (FM 6-15) USE PRESS. CHART NO 2, P. 24 WB

STATION	LOCATION	RELEASE TIME	DATE	HOUR	FLIGHT NO.
MET	FORT CARSON, COLO.	LST / GMT			2a

LEVEL NUMBER	PRESSURE		TEMPERATURE		RELATIVE HUMIDITY	
	CONTACT (1)	MILLIBARS (2)	RECORDER DIVISION (3)	°C (4)	RECORDER DIVISION (5)	% (6)
BASE-LINE CHECK DATA	(INITIAL SETTING) 11.3	(INITIAL SETTING) 932		DRY 21.4°C WET 13.5°C DEP'N		
RELEASE DATA		932		DRY WET DEP'N		
SUR 0		932				
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
26						

DA FORM 1 FEB 74 4197 REPLACES DA FORM 6-43, 1 MAR 62, WHICH WILL BE USED

Instructor Check _____

36. If you have performed all the tasks up to this point in the module in a satisfactory manner, you should be about ready for the criterion test. However, before you take the test you should go back and review anything in the guidance package that you feel that you need. Up to now, the guidance package has presented you with the basics for record evaluation. There are other corrections to apply and special considerations that the operator has to be aware of in record evaluation. For example, we have not covered balloon burst for end of flight. This was due to the length of record required for balloon burst. Balloon burst and other special considerations of covered in FM 6-15. You should make an effort to study this manual thoroughly once you have obtained the MOS 93F.

Note: Inform the instructor when you are ready to take the Criterion Test.

37. The radiosonde data sheet below is for flight 3a on page 25 of WB. Use the data on the sheet and evaluate this record. When you have completed the record then complete the data sheet.

FOR RECORD ON PAGE 25 WB

RADIOSONDE DATA (FM 6-15) USE PRESS CHART NO 3, P 24 WB

STATION	LOCATION	RELEASE TIME	DATE	HOUR	FLIGHT NO.
MET	FORT SILL, OKLA	LST / GMT			3a

LEVEL NUMBER	PRESSURE		TEMPERATURE		RELATIVE HUMIDITY	
	CONTACT (1)	MILLIBARS (2)	RECORDER DIVISION (3)	°C (4)	RECORDER DIVISION (5)	% (6)
BASE-LINE CHECK DATA	(INITIAL SETTING) 7.0	(INITIAL SETTING) 983		DRY 37.3 / WET 24.3 / DEP'N	✓	✓
RELEASE DATA		983		DRY / WET / DEP'N		
SUR 0		983	✓	✓	✓	✓
1	✓	✓				
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
26						

DA FORM 1 FEB 74 4197 REPLACES DA FORM 6-43, 1 MAR 62, WHICH WILL BE USED.

Instructor Check _____

38. The radiosonde data sheet below is for flight 4a on page 26 of WB. Use the data on the sheet and evaluate this record. When you have completed the record then complete the data sheet.

FOR RECORD ON PAGE 26 WB

RADIOSONDE DATA (FM 6-15) USE PRESS CHART NO 1 P.24WB

STATION	LOCATION	RELEASE TIME		DATE	HOUR	FLIGHT NO.
MET	FORT SILL, OKLA		LST			4a
			GMT			

LEVEL NUMBER	PRESSURE		TEMPERATURE		RELATIVE HUMIDITY	
	CONTACT (1)	MILLIBARS (2)	RECORDER DIVISION (3)	°C (4)	RECORDER DIVISION (5)	% (6)
BASE-LINE CHECK DATA	(INITIAL SETTING)	(INITIAL SETTING) 982		DRY 20.0°C WET 13.1°C DEP'N		
RELEASE DATA		982		DRY WET DEP'N		
SUR 0		982				
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
26						

DA FORM 1 FEB 74 4197 REPLACES DA FORM 6-43, 1 MAR 62, WHICH WILL BE USED.

Instructor Check _____

39. The radiosonde data sheet below is for flight 5a on page 27 WB. Use the data on the sheet and evaluate this record. When you have completed the record then complete the data sheet.

FOR RECORD ON PAGE 27 WB

RADIOSONDE DATA (FM 6-15) USE PRESS CHART NO 2, P 24 WB

STATION	LOCATION	RELEASE TIME	DATE	HOUR	FLIGHT NO.
MET	FORT SILL, OKLA	LST / GMT			5a

LEVEL NUMBER	PRESSURE		TEMPERATURE		RELATIVE HUMIDITY	
	CONTACT (1)	MILLIBARS (2)	RECORDER DIVISION (3)	°C (4)	RECORDER DIVISION (5)	% (6)
BASE-LINE CHECK DATA	(INITIAL SETTING) ✓	(INITIAL SETTING) 978	✓	DRY 16.6°C WET 10.1°C DEP'N	✓	✓
RELEASE DATA	✓	978		DRY WET DEP'N		
SUR 0		978	✓	✓	✓	✓
1	✓	✓				
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
26						

DA FORM 1 FEB 74 4197 REPLACES DA FORM 6-43, 1 MAR 62, WHICH WILL BE USED.

Instructor Check _____

40. Congratulations on completing module 2. You have just finished the hardest part of the course. We don't like to think of this module as hard but it is challenging. So much of the learning that takes place in this module is the basis for the remainder of the course.

a. Although you have taken the test, you have not actually operated the Q5 and evaluated the record as it rolls out of the machine. Therefore to make it easier for you, we want you to go to module 5a and operate the Q5 and evaluate the record from live flights. From experience, we have found that this helps the student in being better prepared. You will find when the record comes out of the machine, it looks somewhat different than the printed charts that you have been evaluating.

b. For example Turn to page 28 of the workbook. This record gives some examples that show better representation in what you will be doing and what you might see on a record produced by the recorder.

(1) Look at Ex 1. The linearity correction graft of the Q-5 is attached to the side of the recorder. You must redraw the graft on the bottom of the record. This is done for each flight. The same graft (for a particular Q-5) is used until a new linearity test is performed.

(2) Look at Ex 2. The two prints at 30 and 60 recorder divisions are made while adjusting the sensitivity. First the pen must be allowed to print on zero recorder divisions (if not, adjust the zero adjust). After the pen is printing on zero, the selector switch is placed in 60 CPS then 120 CPS to check sensitivity response of the pen movement (sen. is adjusted if necessary). Note: Pen lifter adj. may be turned to cause tails on traces to 1 to 2 RD in length. When satisfied that pen has good response, show the pen sensitivity check as you learn in module 1 and as shown in Ex 2.

c. The characteristics of many radiosonde recorders cause the pen to drag in to the correct position. This causes no problem if the operator understands the difference between pen drag and valid information. For example, in Ex 3, the operator allowed the pen to print for awhile to see if it would move to 95.0. Once he determined that it was not going to drag all the way to 95.0, he adjusted.

d. Look at Ex 4, all of these low references printed on 95.0 without having to be adjusted. Thus, these low references are valid. The portion of trace not printing on 95.0 is ignored since this is drag caused by recorder characteristics.

e. Look at Ex 5. Note the 10th low reference, it printed on 95.0 without adjustment. However, the 15th low reference had to be adjusted. Note how the operator determined frequency drift at point where the adjustment was made.

f. Look at Ex 6. Due to pen drag, the operator has to be able to determine from the traces what portion is valid weather data.

g. In Ex 7, the operator fails to adjust the low reference. Notice how he handled the frequency drift for this low reference.

h. Look at Ex 8. Many times the humidity traces and temperature traces will be very close together. The operator must be able to determine the difference between humidity and temperature traces.

When you have finished looking the example over on page 28, check with the instructor. If you have any questions about any of the examples, ask the instructor, he will be glad to explain any of them.

You are now ready to operate the recorder and evaluate record as it feeds out of the machine. Notify the instructor and he will arrange for you to work in Module 5a for approximately 14.5 hours.

L 2975 Army-Fort Sill, Okla.

CHANGE
NO. 7

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 9 July 1985

Operator's Manual

RADIOSONDE RECORDERS

AN/TMQ-5 (NSN 6660-00-324-9426)

AN/TMQ-5A (NSN 6660-00-393-2234)

AN/TMQ-5B (NSN 6660-00-393-2234)

AN/TMQ-5C (NSN 6660-00-682-4500)

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Remove	*Insert*
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I-1 through I-3	I-1 through I-3

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CHANGE
NO. 6

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Operator's Manual

RADIOSONDE RECORDERS

AN/TMQ-5 (NSN 6660-00-324-9426)

AN/TMQ-5A (NSN 6660-00-393-2234)

AN/TMQ-5B (NSN 6660-00-393-2234)

AN/TMQ-5C (NSN 6660-00-682-4500)

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1-13 and 1-14	1-13 and 1-14
2-7 and 2-8	2-7 and 2-8
3-7 and 3-8	3-7 and 3-8
4-1 through 4-6	4-1 through 4-6
5-1 and 5-2	5-1 and 5-2
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CHANGE
NO. 5

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Operator's, Manual
RADIOSONDE RECORDERS
AN/TMQ-5 (NSN 6660-00-324-9426)
AN/TMQ-5A (NSN 6660-00-393-2234)
AN/TMQ-5B (NSN 6660-00-393-2234)
AN/TMQ-5C (NSN 6660-00-682-4500)

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NG: None
USAR: None
For explanation of abbreviations used see, AR 310-50.

TECHNICAL MANUAL
NO. 11-6660-204-10

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *6 October 1969*

Operator's Manual

RADIOSONDE RECORDERS

AN/TMQ-5 (NSN 6660-00-324-9426)

AN/TMQ-5A (NSN 6660-00-393-2234)

AN/TMQ-5B (NSN 6660-00-393-2234)

AN/TMQ-5C (NSN 6660-00-682-4500)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-ME-MP, Fort Monmouth, New Jersey 07703-5007.

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*This manual supersedes TM 11-2436, 9 March 1955, including all changes.

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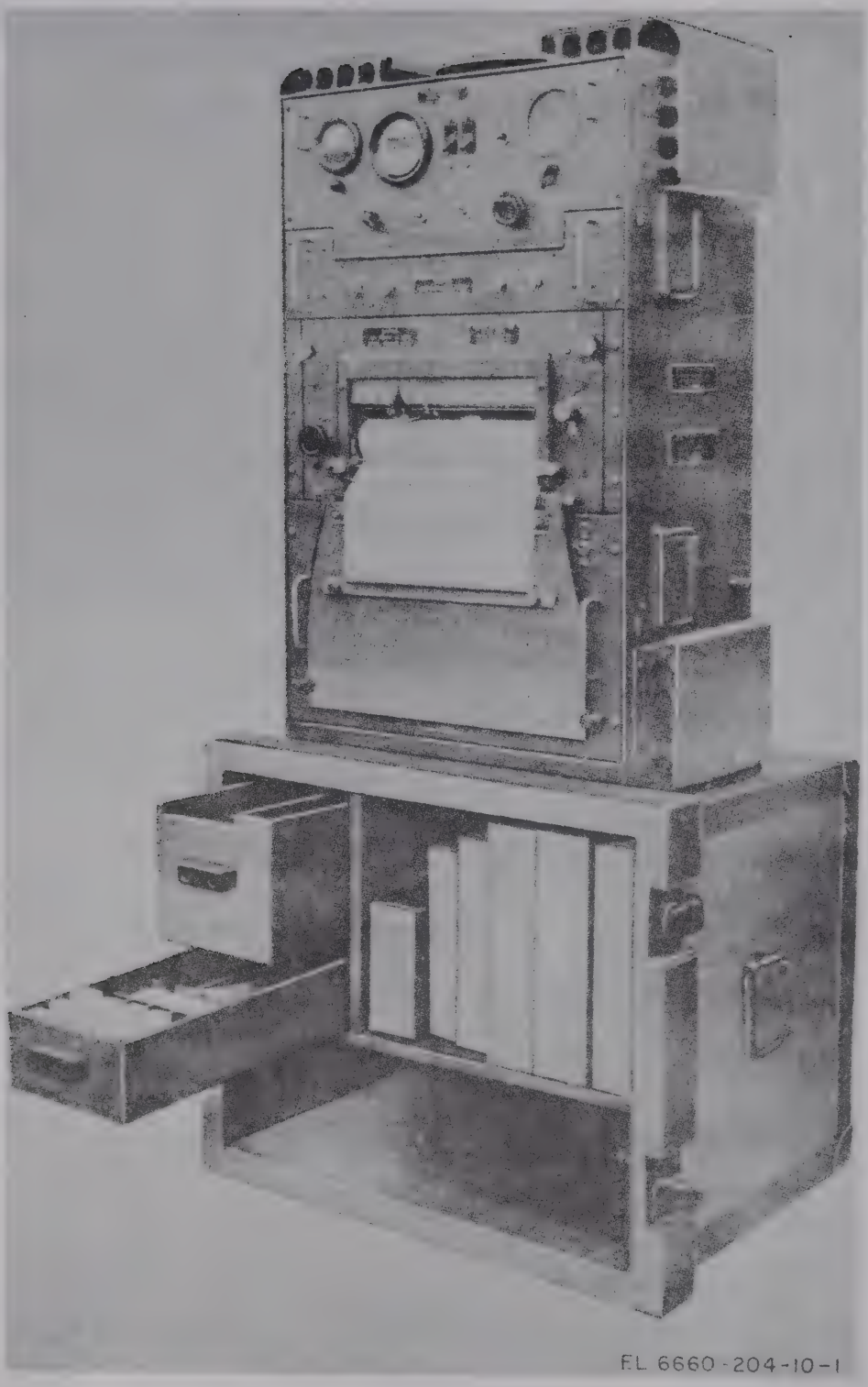


Figure 1-1. Radiosonde Recorder AN/TMQ-5(*).

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

a. This manual covers Radiosonde Recorder AN/TMQ-5(*) (fig. 1-1). Included are installation, operating, and operator's maintenance instructions.

b. Official nomenclature followed by (*) is used to indicate all models of the equipment item covered in this manual. Thus Radiosonde Recorder AN/TMQ-5(*) represents Radiosonde Recorder AN/TMQ-5, AN/TMQ-5A, AN/TMQ-5B, and AN/TMQ-5C; Control Panel C-384(*)/TMQ-5 represents Control Panels C-834/TMQ-5 and C834A/TMQ-5; Signal Data Converters CV-146/TMQ-5 and CV-146A/TMQ-5; Power Supply PP-968(*) TMQ-5 represents Power Supplies PP-968/TMQ-5 and PP-968A/TMQ-5; Electrical Equipment Cabinet CY-1390(*)TMQ-5 represents Electrical Equipment Cabinets CY-1390/TMQ-5 and CY-1390A/TMQ-5; Rawin Set AN/GMD-1(*) represents Rawin Sets AN/GMD-1A, AN/GMD-1B, AN/GMD-1C, and AN/GMD-1C; Radiosonde Set AN/AMT-4(*) represents Radiosonde Sets AN/AMT-4A, B, C, and D; Radiosonde Set AN/AMT-12(*) represents Radiosonde Sets AN/AMT-12 and AN/AMT-12A; Radiosonde Baseline Check Set AN/GMM-1(*) represents Radiosonde Baseline Check Sets AN/GMM-1 and AN/GMM-1A; Computer, Humidity-Temperature CP-223(*)/UM represents Computers, Humidity-Temperature CP-223/UM and CP-223A, B, C/UM; and Control Recorder C-577(*)/GMD-1, represents Control Recorders C-577A/GMD-1, C-577B/GMD-1, and C-577C/GMD-1.

1-2. Consolidated Index of Army Publications and Blank Forms

Refer to the latest issue of DA Pam 310-1 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

1-3. Maintenance Forms, Records, and Reports

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750, Maintenance Management Update.

b. Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38.

1-3.1. Reporting Errors and Recommending Improvements

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028(Recommended Changes to Publications and Blank Forms) direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-ME-MP, Fort Monmouth, New Jersey 07703-5007. In either case, a reply will be furnished direct to you.

1-3.2. Reporting Equipment Improvement Recommendations (EIR)

If your AN/TMQ-5(*) needs improvement, let us know. Send us an EIR. You the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Tell us why a procedure is hard to perform. Put it on an SF 366 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-ME-MP, Fort Monmouth, New Jersey 07703-5007. We'll send you a reply.

1-3.3. Hand Receipt

This manual has a companion document with a TM number followed by "-HR". The TM 11-6660-204-10-HR consists of preprinted hand receipts (DA Form 2062) that list end item related equipment (i.e., COEI, BII, and AAL) you must account for. As an aid to property accountability, additional -HR manuals may be requisitioned from the US Army Adjutant General Publications Center, Baltimore, MD, in accordance with the procedures in Chapter 3, AR 310-2, and DA Pam 310-10-2.

1-3.4. Administrative Storage

Administrative storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the PMCS charts before storing. When removing the equipment from administrative storage the PMCS should be performed to assure operational readiness. Disassembly and repacking of equipment for shipment or limited storage are covered in Chapter 5.

1-3.5. Destruction of Army Electronics Materiel

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

Section II. DESCRIPTION AND DATA

1-4. Purpose and Use

a. Purpose. Radiosonde Recorder AN/TMQ-5(*) is an electronic meteorological recording equipment which graphically records weather information that is transmitted by a balloon-borne radiosonde.

b. Use. A signal is transmitted from the radiosonde, which has a transmitter modulated at au audiofrequency (AF) rate determined by the meteorological factors of the atmosphere. The radiated signals are picked up by the rawin receiver, which amplifies and converts them to AF signals of the proper wave shape. These AF signals are then fed to Radiosonde Recorder AN/TNQ-5(*), which converts them to direct current (dc) voltages; the value of the dc voltage at any instant is proportional to the AF that creates it. This dc voltage excites a servosystem that positions a pen in the recorder, and causes a graph to be drawn on calibrated paper. The record is then evaluated in terms of meteorological data, including temperature, pressure, and humidity.

1-5. Technical Characteristics

The general characteristics and performance data of Radiosonde Recorder AN/TMQ-5(*) are listed below.

Power requirements.....105 to 125 volts, 50 to 60 cycles single-phase, 225 to 275 watts.
Test signal:
  Sine wave.....10 to 220 Hz, 10 volts peak to peak (minimum).
Input signal:
  Negative-going pulse or saw tooth.....10 to 220 Hz, 10 to 100 volts peak to peak, 1,000 to 2,500 μsec wide.
Power supply:
  Positive.....Self-contained, full wave, regulated, +300 volts.
  Negative.....Self-contained, full wave, wave regulated, −175 volts.
Signal data converter output.....Nominally 30 mv dc for fullscale deflection of pen.
Reference adjust frequency range −163 to 242 Hz.
Chart:
  Length.....120 ft
  Width.....10-11/16 in. overall.
  Vertical axis.....1/2 in. intervals.
  Horizontal axis.....100 equal divisions.
Speed.....½ in. per minute for Radiosonde Recorder AN/TMQ5; ½ or 1 in. per minute (operator may choose) for Radiosonde Recorders AN/TMQ-5A and AN/TMQ-5B; ½, 1, or 2 in. per minute for Radiosonde Recorder AN/TMQ-5C.
Speed of response.....2½ seconds maximum, including pen-lifting operation.
Weight.....240 lb.
Dimensions.....33-7/8 in. high, 22-7/8 in. wide, and 17-3/8 in deep.
Number of tubes.....21
Ambient temperature range.....40° to +125°F.

NOTE

Units that include Frequency-Time Recorder RD-88A/TMQ-5 or Frequency-Time Recorder RD-88B/TMQ-5 will operate at either of two different chart speeds, ½ and 1-inch per minute, and operate in automatic or manual time-print synchronization with Control Recorder C-577(*)/GMD-1. Radiosonde Recorder AN/TMQ-5C can operate at any of three different chart speeds: ½, 1, or 2 inches per minute in automatic or manual time-print synchronization with Control Recorder C-577(*)/GMD-1.

1-6. Components and Dimensions

a. Dimensions of Major Components. Major components, their overall dimensions, weights, and references to figures illustrating these components are listed below.

Item	Overall Dimensions (in.)			Weight (lb)	Reference figure
	Height	Length	Depth		
Control Panel C-834(*)/TMQ-5	10½	19	5	10	1-4
Signal Data Converter (CV-146) (*)/TMQ-5	9¾	19	11 5/8	18	1-4
Power Supply PP-968(*)/TMQ-5	10	19	11 5/8	39	1-4
Frequency-Time Recorder RD-88(*) TMQ-5	8¾	19	10¾	34	1-2, 1-4
Electrical Equipment Cabinet Subassembly MX-1482/TMQ-5	10¼	19	3	5	1-2
Electrical Equipment Cabinet CY-1390(*)/TMQ-5	33 7/8	22 7/8	17	130	1-2, 1-4
Accessories Case CY-930/TMQ-5	21	27¼	19 5/8	66	1-1, 1-7, 1-8

1-6.1. Items Comprising an Operable Equipment

NSN	Qty	Nomenclature, part No., and mfr code	Usable-on code	Fig.
		NOTE The part number is followed by the applicable 5-digit Federal supply code for manufacturers (FSCM) identified in SB 708-42 and used to identify manufacturer, distributor, or Government agency; etc.		
		NOTE Number 1 in the usable-on code column refers to items comprising an operable AN/TMQ-5; number 2 refers to items comprising an operable AN/TMQ-5A; number 3 refers to items comprising an operable AN/TMQ-5B: number 4 refers to items comprising an operable AN/TMQ-5C.		
6660-00-324-9426		Radiosonde Recorder: AN/TMQ-5		
6660-00-393-2234		Radiosonde Recorder AN/TMQ-5A; AN/TMQ-5B		
6660-00-682-4500		Radiosonde Recorder AN/TMQ-5C consisting of:		
6660-00-343-0370	1	Cabinet, Electrical Equipment CY-1390/TMQ-5, CY-1390A/TMQ-5.	1,2,3,4	1-6
6660-00-614-9859	1	Cabinet Sub-Assembly, Electrical Equipment MX-1482/TMQ-5.	1,2,3,4	1-6
6660-00-306-2126	1	Cable Assembly, Special Purpose, Electrical CX-2337/TMQ-5.	1,2	
6660-00-170-8777	1	Cable Assembly, Power Electrical CX-1492/U	1,2	
6660-00-503-0671	5	Cable Assembly, Special Purpose, Electrical CX-2338/U.	1,2,3,4	
6660-00-503-0672	1	Cable Assembly, Special Purpose, Electrical CX-2339/U.	1,2,3,4	1-7
6660-00-503-0713	1	Recorder, Frequency Time RD-88A/TMQ-5, RD-88B/TMQ-5.	1,2,3,4	1-4
6660-00-725-7917	1	Recorder, Frequency Time RD-88/TMQ-5 RD-88C/TMQ-5.	1,2,3,4	1-5
		NOTE Number 1 in the usable on code column Refers to items comprising an operable RD-88/TMQ-5; number 2 refers to items comprising an operable RD-S-88A/TMQ-5; number 3 refers to items comprising an operable RD-88B/TMQ-5; number 4 refers to items comprising an operable RD-88C/TMQ-5.		
666-00-663-7917	1	Pen, Recorder: SK-5320-598; 35529	1,2,3,4	
5129-00-236-2140	1	Screwdriver, SC-A-4225; 80063	1,2,3,4	
		ACCESSORIES, TOOLS, AND TEST EQUIPMENT		
6660-00-370-3725	1	Desk Log: SC-D-125505; 80063	1,2,3,4	
6660-00-377-0176	1	Wire Rope Assembly, Single Leg: SC-B-125626; 80063.	1,2,3,4	
5120-00-293-1839	1	Wrench, Open End, Fixed: 0.753″ and 0.878″ openings; SC-B-125071; 80063	1,2,3,4	
6660-00-788-2133	1	Chart Weight Assembly: SC-C-125081:80063	1,2,3,4	
6660-00-179-5846	1	Computer, Humidity, Temperature, CP-223/UM*	1,2,3,4	
6660-00-503-0669	1	Converter, Signal DATA CV-146/TMQ-5, CV-146A/TMQ-5; SC-DL-125300; 80063.	1,2,3,4	
		NOTE Number 1 in the usable on code column refers to items comprising an operable CV-146A/TMQ-5; number 2 refers to items comprising an operable CV-146/TMQ-5.		
6110-00-546-3094	1	Panel, Control C-834/TMQ-5; C-834A/TMQ-5	1,2,3,4	
6660-00-533-1946	1	Power Supply PP-968/TMQ-5; PP-968A/TMQ-5	1,2,3,4	

*** Refer to paragraph 3-16.**

1-6.2. Expendable Consumable Items

A list of expendable consumable items required for operation appears in table 1-1. The supplies and material listed in this table are required for operation of this equipment and are authorized to be requisitioned by SB 700-50. The NSN for the applicable unit of issue required can be found in appropriate supply catalog. The FSCM is used as an element in item identification to designate manufacturer, distributor, or Government agency; etc., and is identified in SB 708-42.

Table 1-1. Expendable Consumable Supplies and Material

Item	*Description*	*Ref. No.*	*FSC*
Ink, Writing		125070	
Paper, Graph MIL-432A/TMQ-5	Alcohol, Isopropyl:	35529	7510 6660 6505

1-7. Common Names

a. A list of common names for the components of Radiosonde Recorder AN/TMQ-5(*) is given below.

Nomenclature	Common name
Radiosonde Recorder AN/TMQ-5(*).	Radiosonde recorder
Control Panel C-834(*)/TMQ-5	Control panel
Signal Data Converter CV 146(*)/TMQ-5	Converter-amplifier
Power Supply PP-968(*)/-TMQ-5	Power supply
Frequency Time Recorder RD-88(*)/TMQ-5	Frequency-time recorder
Electrical Equipment Cabinet Subassembly MX-1482/TMQ-5	Fan panel
Electrical Equipment Cabinet CY-1390(*)/TMQ-5	Cabinet
Accessories Case CY-930/TMQ-5	Accessories case
Electrical Special Purpose Cable Assembly CX-2339/U.	Power supply test cable
Electrical Special Purpose Cable Assembly CX-2338/U	Test cable
Electrical Special Purpose Cable Assembly CX-2337/TMQ-5	Signal and power cable
Power Cable Assembly CX-1492/U	Power adapter cab
Graph Paper ML-432/TMQ-5	Chart

b. A list of common names for equipment used with Radiosonde Recorder AN/TMQ-5(*) is given below.

Nomenclature	Common name
Baseline Check Set AN/GMM-1(*)	Baseline check set
Rawin Set AN/GMD-1(*)	Rawin set
Rawin Receiver R-301(*)/GMD-1	Rawin receiver
Radiosonde Set AN/AMT-4(*)	Radiosonde set
Radiosonde Set AN/AMT-12(*)	Radiosonde set with hypsometer

1-8. Description of Equipment

a. Overall Description. The major components of Radiosonde Recorder AN/TMQ-5(*) are assembled in a single chart (fig. 1-2). All chassis and panels are of the plug-in type and are easily removed for maintenance. Test cables enable any or all major units to be operated when they are removed from the cabinet for test or repair.

b. Description of Major Components. A description of each major component is contained in (1) through (5) below.

(1) *Control Panel C-834(*)/TMQ-5.* The control panel is located in the upper front portion of the cabinet (fig. 1-2). The upper section of the control panel (fig. 1-3) is hinged and may be opened without interrupting operation to gain access to the converter-amplifier chassis. The speaker, meters, and majority of operating controls are mounted on the hinged section of the control panel. Four screwdriver adjustments are on the bottom unhinged section of the panel.

(2) *Signal Data Converter CV-146(*)/TMQ-5.* The converter-amplifier chassis is mounted vertically to the upper rear of the cabinet (fig. 1-4), directly behind the control panel. The converter-amplifier converts and amplifies the audiofrequency signals from the rawin set to a dc voltage that is directly proportional to the frequency of the input signal. This dc voltage is amplified further in the power supply chassis and is used to operate the frequency-time recorder.

(3) *Frequency Time Recorder RD-88(*)/TMQ-5.* The frequency-time recorder (fig. 1-5) is in the middle of the cabinet (fig. 1-2 and 1-4). It contains the printing mechanism and chart paper. A knob on the left side of the panel is used to advance the chart manually to a desired position. The pen control knob is on the right-hand side of the panel. When this control is locked, it will hold the pen above the chart. The desk (fig. 1-2) is attached to the front of the frequency-time recorder, so the operator may make notations on the chart during operation. When the desk is not in use, it may be placed flush with the cabinet or removed. The frequency-time recorder chassis is mounted on a slide-track assembly, and a short length of cable allows the unit to be drawn part way out of the cabinet without disturbing operation.

(4) *Power Supply PP-968(*)/TMQ-5.* The power supply chassis is mounted vertically at the rear of the cabinet (fig. 1-4). It contains one positive regulated supply, one negative regulated supply, the servo power amplifiers, and the penlifter circuit. All tubes are replaced from the rear of the cabinet. To gain access to the bottom of the power supply chassis, remove the fan panel on the lower front section of the cabinet.

(5) *Electrical Equipment Cabinet Subassembly MS-1482/TMQ-5.* The fan panel (fig. 1-6) contains a ventilating fan and an associated switch. It is located on the bottom front of the cabinet. When the vent on the top of the cabinet is open, the fan circulates air throughout the equipment.

c. Description of Minor Components.

(1) *Accessories Case CY-930/TMQ-5.* The accessories case (fig. 1-7) is made of plywood and aluminum. It contains two drawers and two compartments in which the accessories and running spares are stored. The recorder is mounted on top of the accessories case during operation.

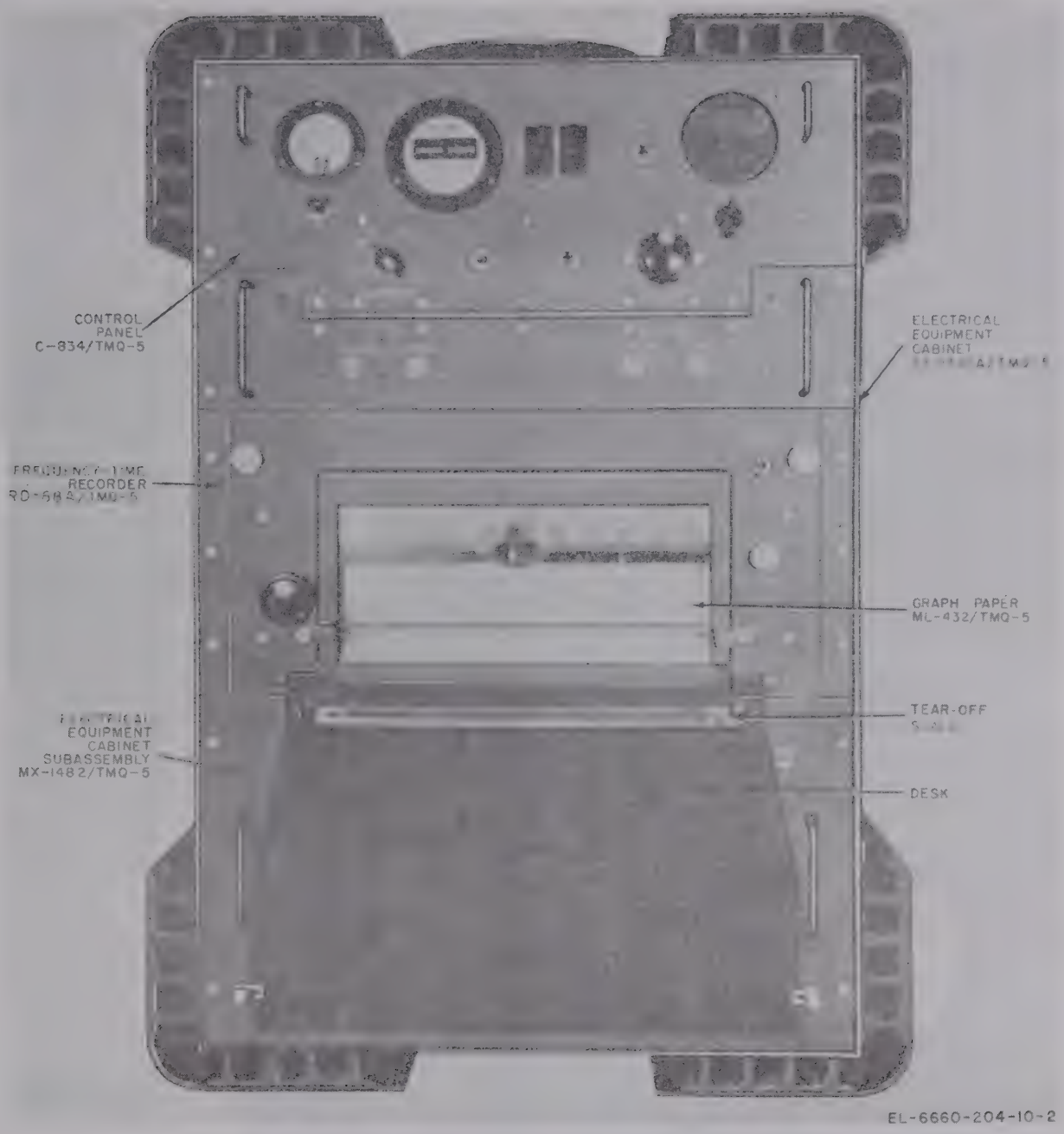
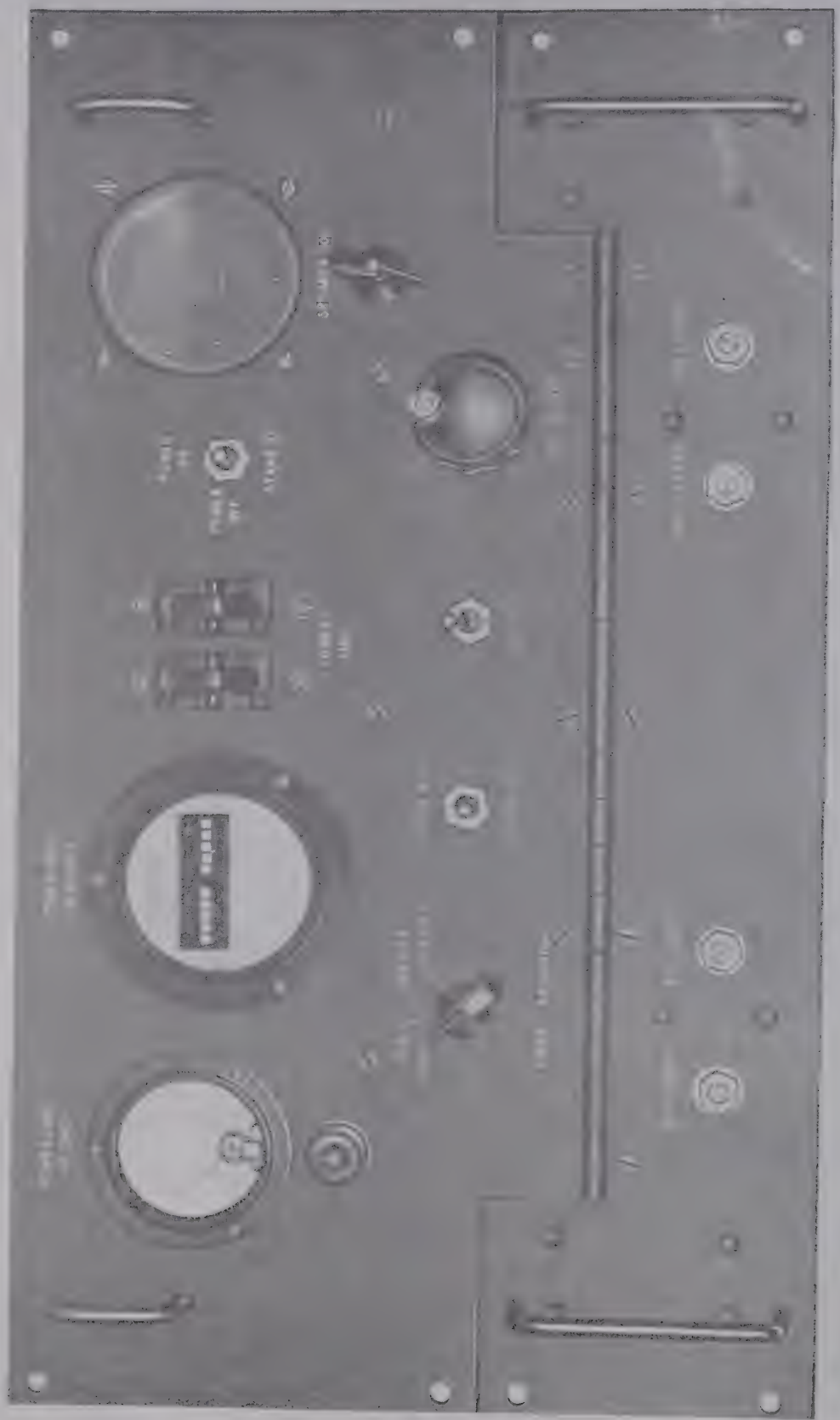


Figure 1-2. Radiosonde Recorder AN/TMQ-5(*), front view.

(2) *Running spares.* The following group of running spares is supplied with each Radiosonde Recorder AN/TMQ-5(*).

1 inverter (vibrator) G301.
2 tubes type 12AT7WA.
1 tube type 12AX7.
1 tube type 12AY7.
1 tube type 5751.
1 tube type 5814A.
1 tube type 5 R4WGA.
1 tube type 6Y6GT.
1 tube type 6AU6.
1 tube type 5651.
1 tube type 6AS7G.
1 tube type 6AQ5W.
1 tube type 12AU7.
2 tubes of ink.
1 neon lamp type NE-51.
2 incandescent lamps type 44.
12 chart rolls.
5 fuses, 1/8 ampere, 3 AG, slow blow.
5 fuses, 0.3 ampere, slow blow.
1 drive cable.
1 slide wire contact and hardware.
1 pen.



EL 6660-204-10-3

Figure 1-3. Control Panel C-834(*)/TMQ-5, front view.

1-9. Differences in Models

a. The four models of radiosonde recorder are identical in size, shape, and general appearance. However, the later models have been modified to improve operational features. The differences among the various models are listed in *b*, *c*, *d*, and *e* below.

b. Frequency-Time Recorder RD-88/TMQ-5 may be used with Electrical Equipment Cabinet CY-1390/TMQ-5 or CY-1390A/TMQ-5. In either case, the time-print circuit is inoperative and only one chart speed, 1/2 inch per minute is available.

c. Frequency-Time Recorders RD-88A/TMQ-5 and RD-88B/TMQ-5 may be used interchangeably with both models of the cabinet. However, when the A- or B-model of the frequency-time recorder is used with Electrical Equipment Cabinet CY-1390/TMQ-5, the time-print circuit is inoperative, although the dual chart speed feature is still available.

d. In Radiosonde Recorder AN/TMQ-5B, ruggedized tubes replace the earlier types at various points in the circuit. These changes are as follows:

(1) In the power supply, rectifiers V401 and V408 are changed from type 5R4GWY to 5R4GWA.

(2) In the converter, tubes V304 through V307, are changed from type 12AT7 to 12AT7WA; tubes V301 and V303 are changed from type 12AU7 to 5814A; and tubes V302 and V310 are changed from type 12AX7 to 5751.

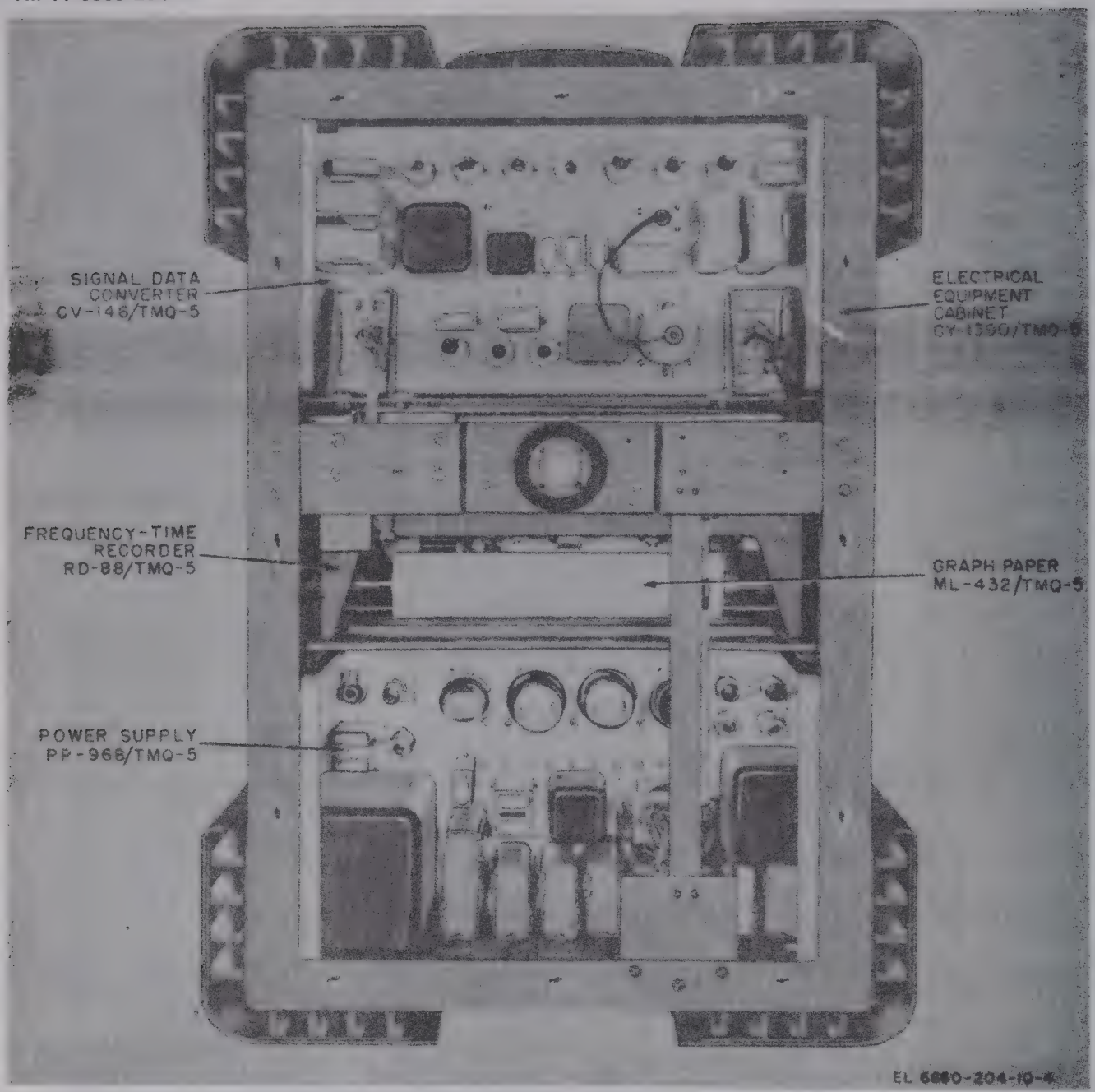


Figure 1-4. Radiosonde Recorder AN/TMQ-5(*), rear view.

e. Differences among models are as follows:

Item	AN/TMQ-5	AN/TMQ-5A	AN/TMQ-5B	AN/TMQ-5C
Control panel	C-834/TMQ-5	C-834/TMQ-5	C-834/TMQ-5 is the same as C-834/TMQ-5, except that the resistor bracket contains standard resistors and appropriate mounting hardware. The unit is electrically and physically interchangeable with the C-834/TMQ-5.	Same as AN/TMQ-5B.

Item	AN/TMQ-5	AN/TMQ-5A	AN/TMQ-5B	AN/TMQ-5C
Converter-amplifier	CV-146/TMQ-5	CV-146/TMQ-5	CV-146A/TMQ-5 is the same as CV-146/TMQ-5, except that ruggedized tubes are used, test jacks are color coded, and R331 is a standard resistor with appropriate mounting hardware. The unit is electrically and physically interchangeable with the CV-146/TMQ-5.	Same as AN/TMQ-5B.
Power supply	PP-968/TMQ-5	PP-968/TMQ-5	PP-968A/TMQ-5 is the same as PP-968/TMQ-5, except that ruggedized tubes are used, top-hat tube clamps are installed on the rectifiers, and test jacks are color coded. The unit is electrically and physically interchangeable with the PP-968/TMQ-5.	Same as AN/TMQ-5B.
Frequency-Time recorder.	RD-88/TMQ-5. This unit has a single chart speed of ½ inch per minute.	RD-88A/TMQ-5 has selective chart speeds of ½ and 1 inch per minute, by means of chart speed switch (fig. 2-4). A time-print switch (mounted on the panel) controls the operation of a camoperated microswitch, which controls the operation of the time-print circuit of Control Recorder C-577(*)/GMD-1, a part of Rawin Set AN/GMD-1(*).	RD-88B/TMQ-5 is the same as RD-88A/TMQ-5, except that the time-print switch of the frequency-time recorder panel is mounted on a bracket, rather than on the panel itself and a plug and receptacle are installed in the light circuit. These features facilitate removal of the panel.	RD-88C/TMQ-5 is the same as RD-88B/TMQ-5, except that RD-88C/TMQ-5 has pushbutton control (fig. 3-2) to select any of three speeds (½, 1, or 2 inches per minute).
Electrical Equipment Cabinet.	CY-1390/TMQ-5	CY-1390A/TMQ-5 is the same as CY-1390/TMQ-5 except that the wiring harnesses are modified to connect the RAWIN TIME PRINT switch to J101.	CY-1390A/TMQ-5 is the same as the CY-1390/TMQ-5 used with Radiosonde Recorder AN/TMQ-5A except that tube pin straighteners are mounted in the bottom of the cabinet and a grounding post is included.	Same as AN/TMQ-5B.
Signal and power cable.	CX-2337/TMQ-5 has a twist-lock male power connector.	CX-2337/TMQ-5 has a twist-lock male power connector.	CX-3711/TMQ-5 uses a standard-type power connector. Designed for use with the CX-3712/U when required.	Same as AN/TMQ-5B.

1-10. System Application

a. General. All rawinsonde systems operate on the same principles. The operation of the radiosonde system that comprises Radiosonde Set AN/AMT-4(*), Radiosonde Set AN/AMT-12(*), Rawin Set AN/GMD-1(*), and Radiosonde Re-

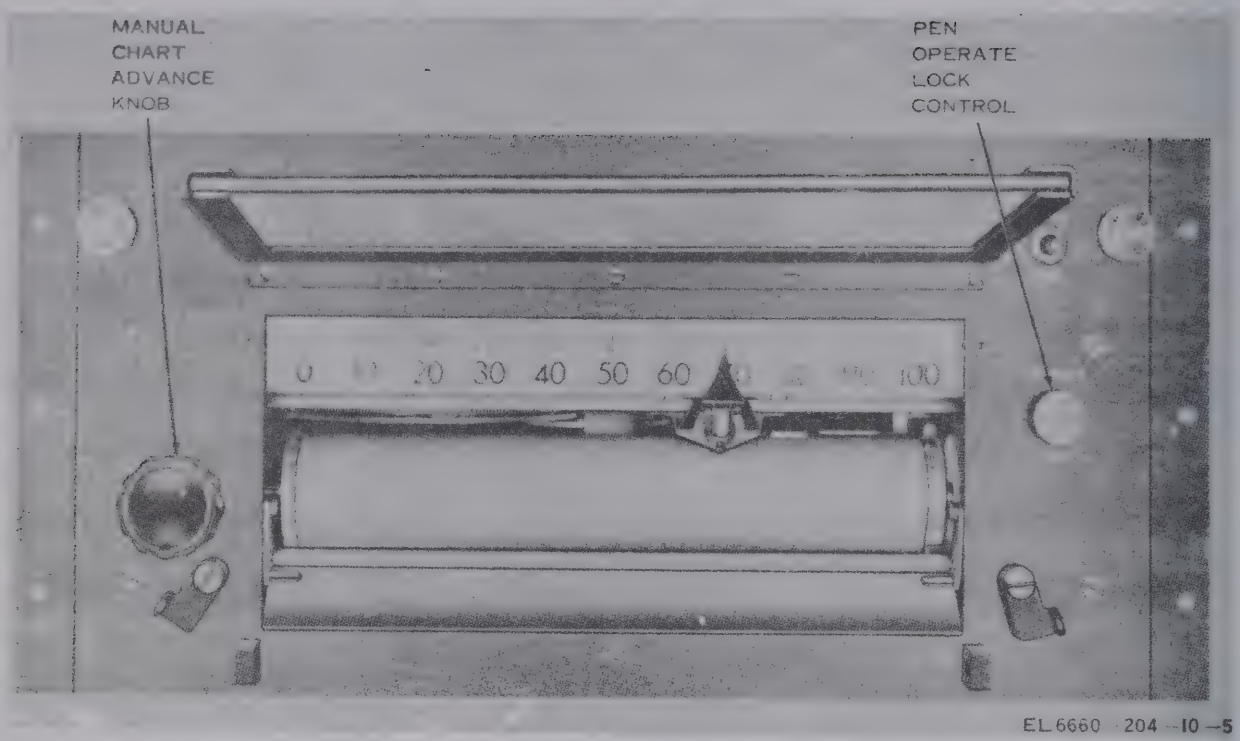


Figure 1–5. Frequency-Time Recorder RD–88(*)/TMQ–5, front view.

Figure 1–6. Electrical Equipment Cabinet Subassembly MX–1482/TMQ–5.

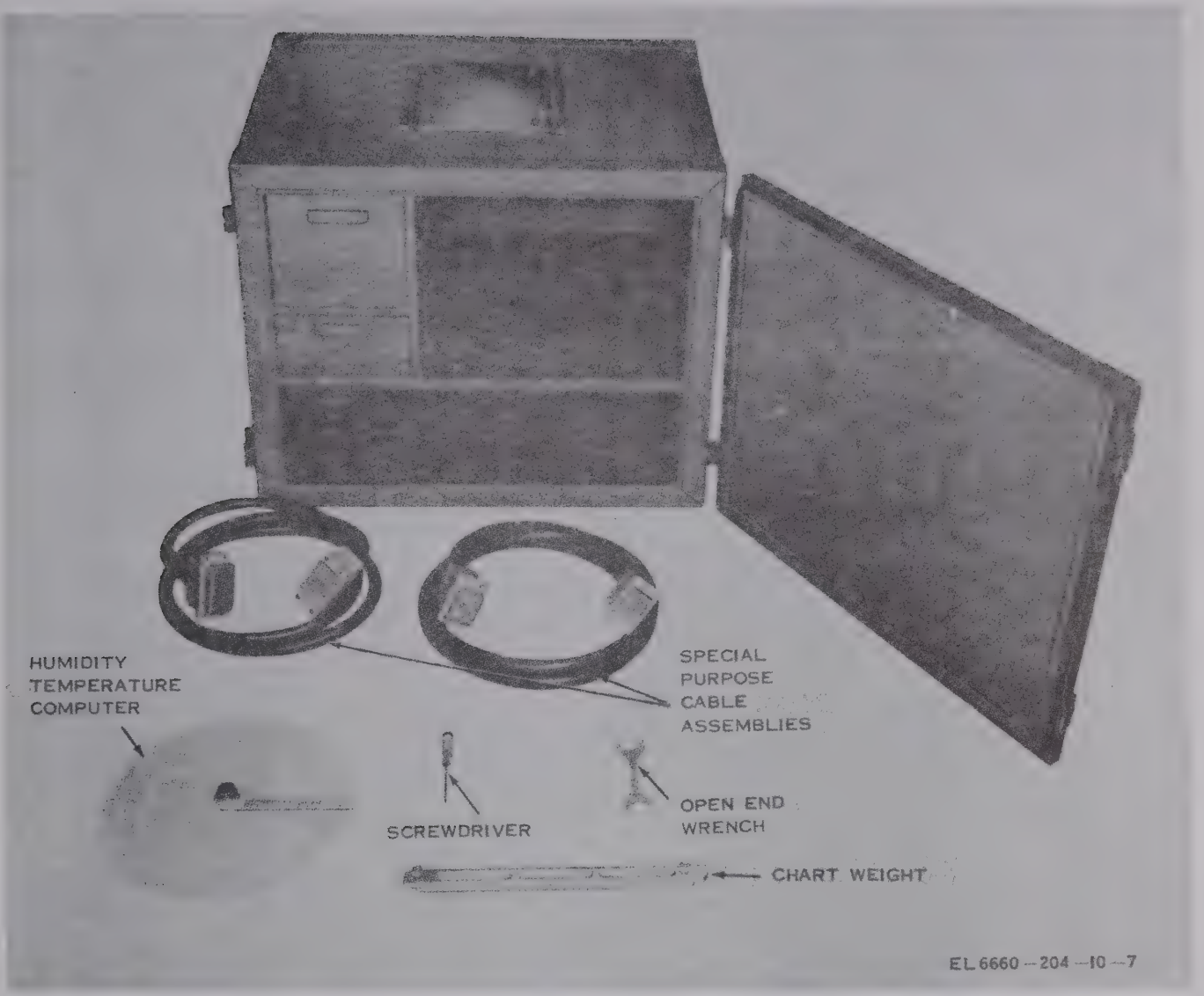


Figure 1–7. Accessories Case CY–930/TMQ–5, with some accessories.

corder AN/TMQ–5(*) are covered in *b*, *c*, and *d* below.

b. Radiosonde Sets AN/AMT–4(*) and AN/AMT–12(*). Radiosonde Sets AN/AMT–4(*) and AN/AMT–12(*) (fig. 1–8) are balloon-borne meteorological instruments that automatically transmit information to a ground meteorological station; this information relates to the pressure, temperature, and humidity of the upper air strata. The radiosonde transmits an amplitude-modulated signal at a carrier frequency of 1,680 (nominal) megacycles per second (MHz). A radiosonde modulator unit contains a pressure-sensitive element (aneroid), a temperature element (fig. 1–9), and a humidity element. A commutator bar is used as a switching arrangement to sequence the signals that are transmitted by the radiosonde.

c. Rawin Set AN/GMD–1(*). The rawin set (fig. 1–10) automatically tracks the radiosonde during flight, and receives, amplifies, and demodulates the radiosonde signals to their original audiofrequency.

d. Radiosonde Recorder AN/TMQ–5(*). The AF signal output of the rawin set is applied to the signal converter section of the converter-amplifier in the radiosonde recorder (fig. 1–11). In this section, the AF signals are amplified and shaped to a precise amplitude and form; then they are rectified and filtered to provide a dc voltage that is proportional to their frequency (nominally from 10 to 200 cycles per second (Hz)). A second dc

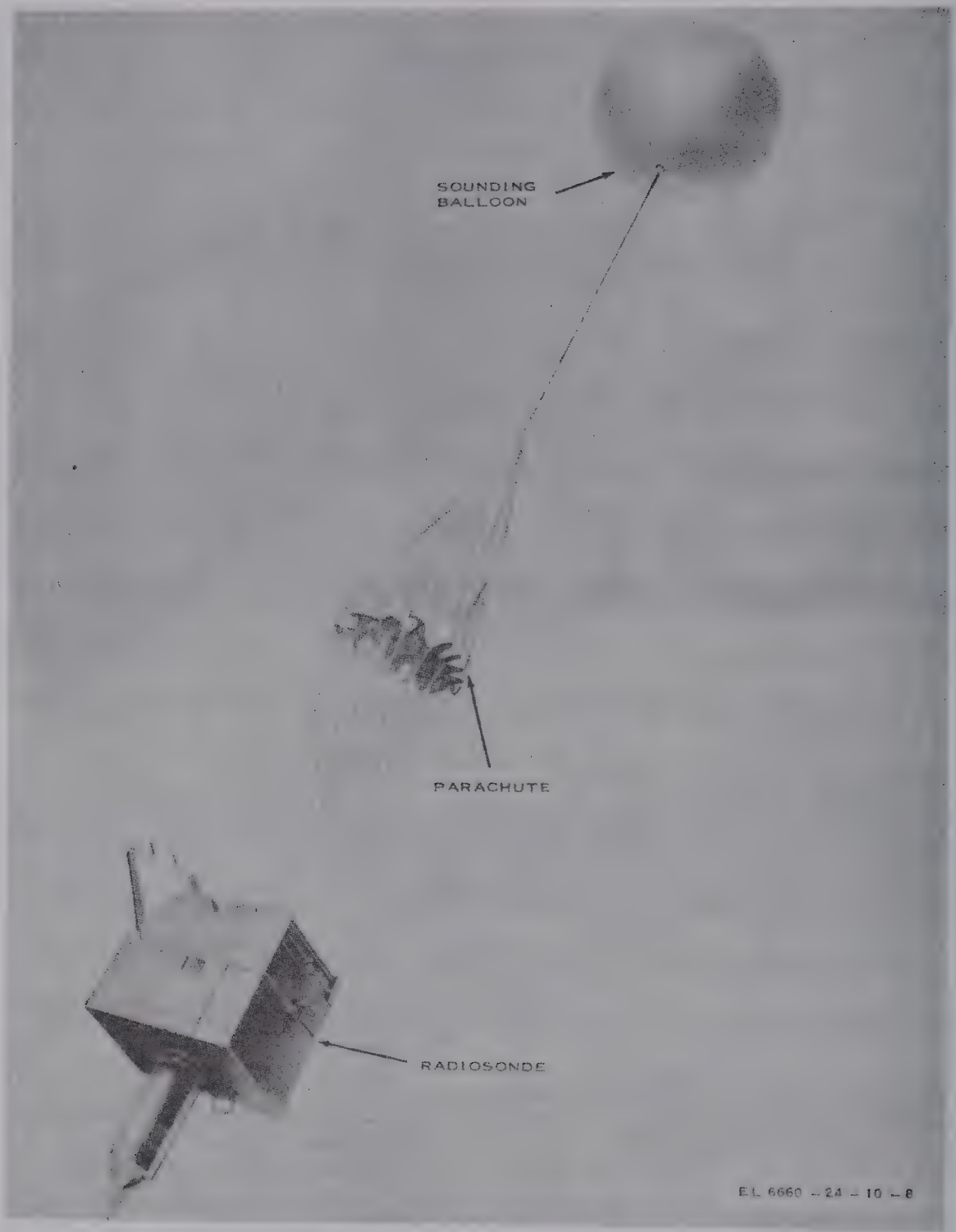


Figure 1-8. Radiosonde with parachute and sounding balloon.

voltage is supplied by the motor-driven contact of a slide-wire potentiometer. The two dc voltages are applied to a detection circuit, which converts any difference to a 60-Hz error voltage. This error voltage is then amplified to a level that is sufficient to drive the balancing (or servo) motor and operate the pen-lifting circuit; if the error voltage is present, the pen is lifted while the motor positions it for the next recording. The motor stops when the dc voltage at the moving contact of the slide-wire potentiometer, is equal to that delivered by the rectified signal; the pen is then lowered

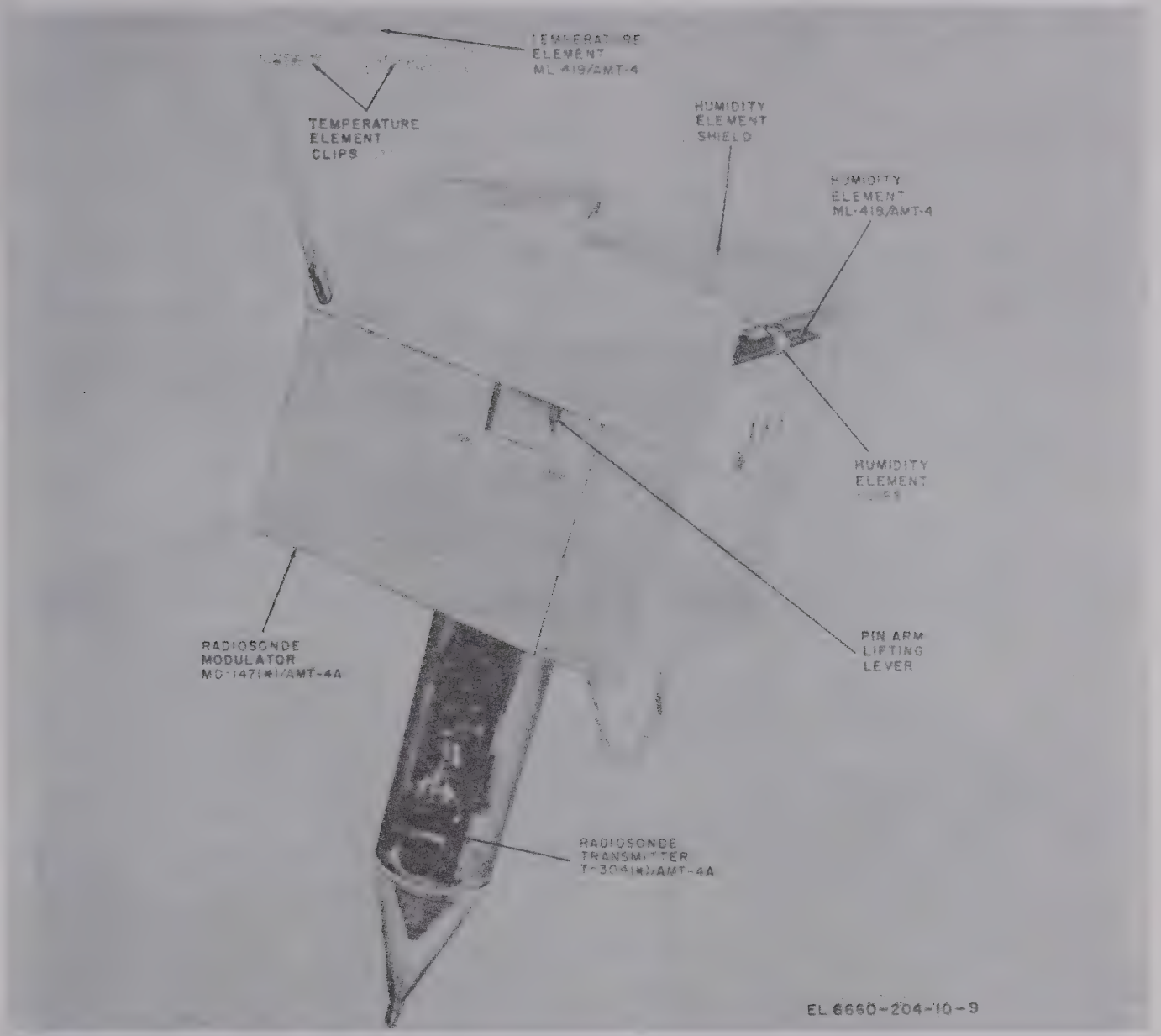


Figure 1–9. Radiosonde modulator and transmitter.

again to the moving paper and a trace is made. The entire operation takes place so the pen always marks the chart at a point which corresponds to the meteorological information that is received from the radiosonde.

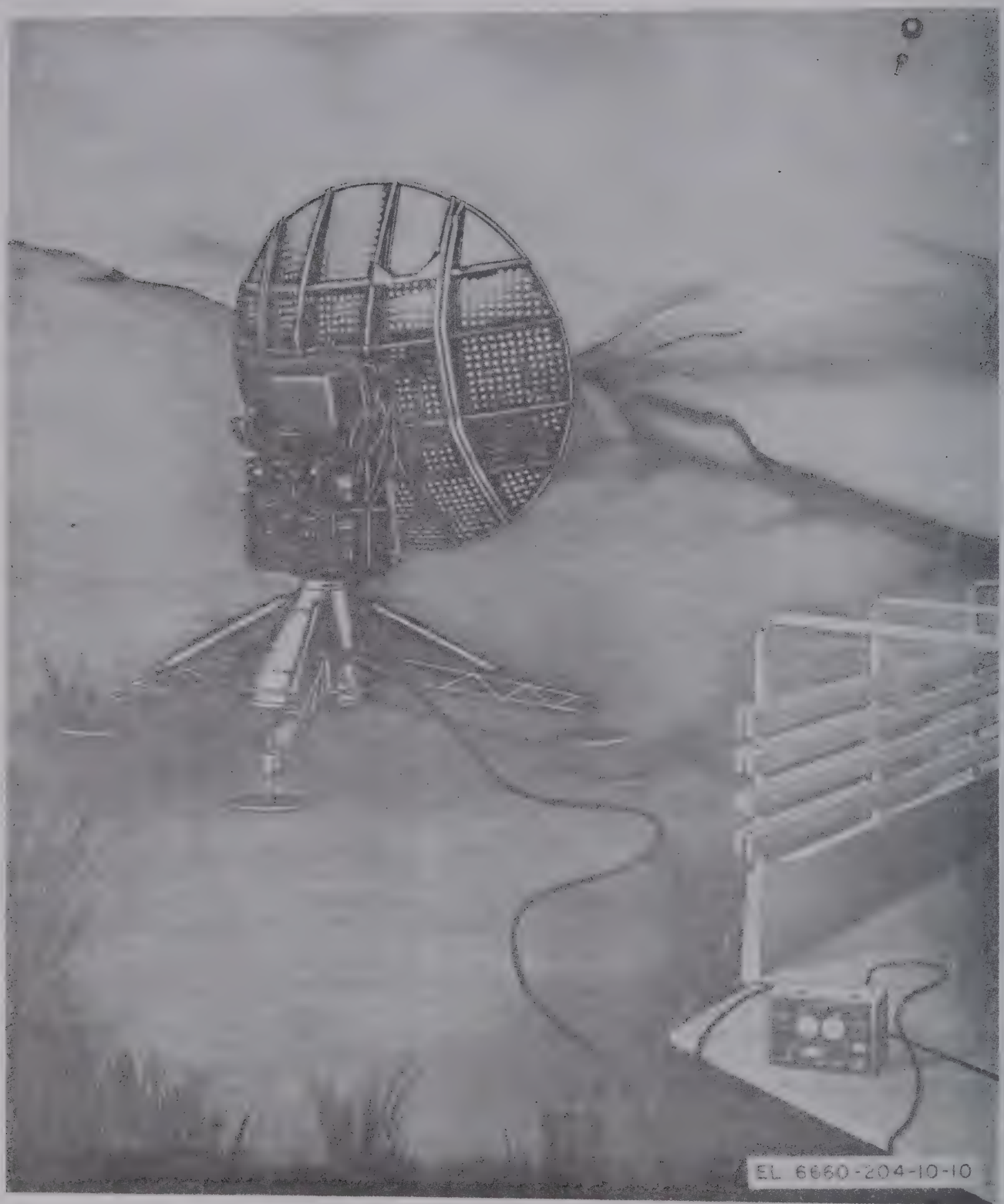


Figure 1-10. Rawin Set AN/GMD-1(*).

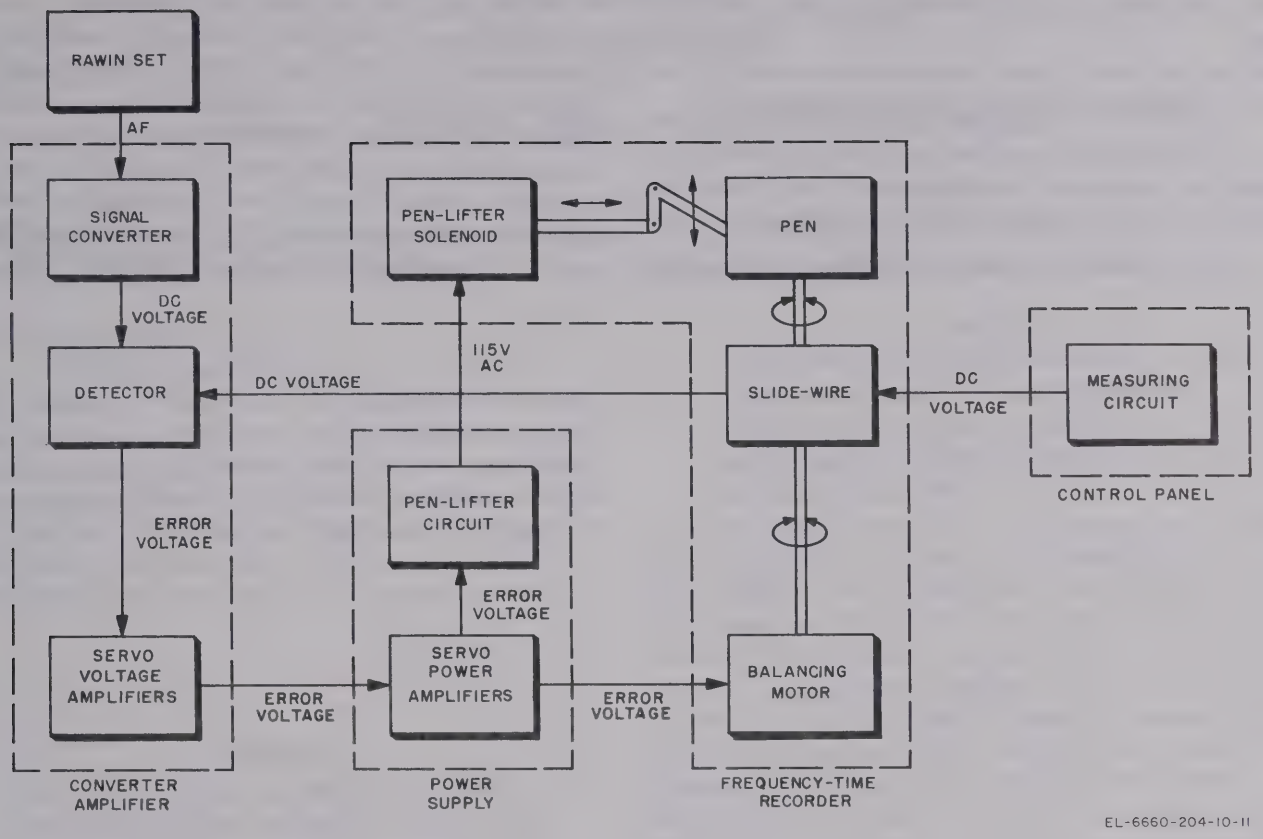


Figure 1–11. Radiosonde Recorder AN/TMQ–5, simplified block diagram.

Section III. DESCRIPTION OF ADDITIONAL EQUIPMENT REQUIRED BUT NOT SUPPLIED WITH RADIOSONDE RECORDER AN/TMQ–5(*)

1–11. Radiosonde Sets AN/AMT–4(*) and AN/AMT–12(*)

a. Radiosonde Sets AN/AMT–4(*) and AN/AMT–12(*) (fig. 1–8) are balloon-borne, battery-powered meteorological instruments that automatically transmit radio signals relating to the pressure, temperature, and humidity of the upper air-to-ground receiving equipment.

b. Signals transmitted by Radiosonde Set AN/AMT–4(*) (TM 11–6660–228–10) or Radiosonde Set AN/AMT–12(*) (TM 11–6660–220–10) are received by Rawin Set AN/GMD–1(*) (TM 11–6660–206–12), which is interconnected to Radiosonde Recorder AN/TMQ–5(*). The radiosonde recorder prepares a flight record on calibrated graph paper that is used to evaluate the information received from the radiosonde set.

c. Meteorological data provided by the radiosonde set is used for analyzing and forecasting weather conditions, guiding aircraft, planning missions for aircraft, and preparing ballistic correction data for the effect of the atmosphere on the trajectory of artillery projectiles, missiles, and rockets.

d. Each radiosonde set includes a modulator, a transmitter, a temperature and humidity element, and a calibration chart. Radiosonde Set AN/AMT–12(*) has a hypsometer unit which is used to evaluate pressure data at high altitudes, for greater accuracy. Detailed information on the use of radiosonde sets and their accessories are contained in their respective manuals.

1–12. Rawin Set AN/GMD–1(*)

Signals transmitted by the radiosonde set are received by the rawin set tracking the balloon-borne radiosonde set. The signals are amplified by the rawin receiver, demodulated and fed to the radio-

sonde recorder in af pulses ranging from 10 to 200 Hz.

1-13. Baseline Check Set AN/GMM-1(*)

a. The baseline check set provides a chamber to maintain controlled temperatures and humidity conditions for preflight testing of radiosonde sets.

b. The baseline check set makes a complete check of the temperature and humidity elements of Radiosonde Set AN/AMT-4(*) and Radiosonde Set AN/AMT-12(*). The baseline check set indicates whether the radiosonde being tested is operating properly. The meteorological values are transmitted to the radiosonde recorder which records on graphic paper, the temperature, humidity, and reference values for use in setting Computer, Humidity-Temperature CP-223C/UM.

CHAPTER 2
INSTALLATION

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

NOTE

When the cabinet, control panel, converter-amplifier, frequency-time recorder, power supply, and fan panel are referred to as an integral unit, they will be called the radiosonde recorder.

2-1. Unpacking (Fig 2-1 and 2-1.)

a. General. When new equipment is received, select a location which is convenient to permanent or semipermanent equipment installation, and where the equipment may be unpacked without exposure to the weather. The complete equipment is shipped in two boxes. Be sure that both packing boxes are received and the equipment is undamaged.

CAUTION

Be careful when uncrating, unpacking, and handling the equipment; it is easily damaged. If it becomes damaged or exposed, a complete overhaul may be required or the equipment may be rendered useless. Do not thrust tools into the interior of any container or wrap. Select a site close to the base of operation that is free from dust and excessive moisture.

NOTE

Items may be packaged as shown in table 2-1, depending on the supply channel. In some units, the tubes are installed in the power supply; in other units, the tubes are packaged separately.

b. Packaging Data. When packaged and packed for oversea shipment, Radiosonde Recorder AN/TMQ-5(*)the Accessories Case CY-930/TMQ-5 are packaged in water-resistant fiberboard cartons with all seams and joints sealed with water-resistant, pressure-sensitive tape. Further protection is afforded the radiosonde recorder by packing it in a nailed, wooden box. When packaged and packed for domestic shipment, the methods applied may vary depending on the source. Shipping containers shall comply with the rules and regulations of the carrier, applicable to the mode of transportation.

c. Uncrating Radiosonde Recorder (fig. 2-1). Perform all the steps outlined below when unpacking equipment packaged in wooden boxes. When unpacking equipment in cartons, omit the procedure given in (1) below.

Table 2-1. Packaging Data

Box No.	Components	Overall Dimensions (in.)			Volume (cu ft)	Shipping weight (lb)
		Length	Width	Depth		
1	Electrical Equipment Cabinet CY-1390(*)/TMQ-5 The following components are mounted in the cabinets. Control Panel C-384(*)/TMQ-5 Signal Data Converter CV-146(*)/TMQ-5 Frequency-Time Recorder RD-88(*)/TMQ-5, less chart and ink. Power Supply PP-968A/TMQ-5 complete or Power Supply PP-968/TMQ, less the following tubes: V401 5R4W or 5R4WGA V402 6Y6GY V408 5R4WGY or 5R4WGA V409 6AS7G Electrical Equipment Cabinet Sumassembly MX-1482/TMQ-5.	46 1/4	33 1/2	30 1/4	27	490
2	Accessories Case CY-930/TMQ-5. The following items are included in the accessories case: Running spares Accessories Items removed from recorder for shipment	24	30 1/4	21 1/8	9	138

CAUTION

Be careful when unpacking and unpackaging the equipment. Do not thrust tools into the interior of any container or wrap. Select a site close to the base of operation that is free from dust and excessive moisture.

(1) *Unpacking (when received overseas).* Cut the steel straps just below the box cover, and fold back the cover. Remove the nails from the top, side, and end with a nailpuller and remove the top, side, and end.

(2) *Unpackaging (when received overseas).* Remove the fiberboard container and cut through the three edges of the container. Remove the contents.

(3) *Unpackaging (when received in CONUS).* Follow the applicable procedures as specified in (1) and (2) above.

d. Uncrating Accessories Case (fig. 2-2). Uncrate the accessories case as follows:

(1) Cut and fold back the steel straps on the nailed, wooden shipping box.

(2) Use a nailpuller to remove the nails. Remove the top and one side of the box. Do not attempt to pry off the side and top; the accessories case may become damaged.

(3) Lift out and cut the moisture-vaporproof barrier along the heat-sealed seam; remove the barrier.

(4) Remove the V2S board carton. Remove the inner carton, and lift out the accessories case.

2-2. Checking Unpacked Equipment

a. Checking Equipment for Completeness. See that the equipment is complete as listed on the packing slip. If a packing slip is not available see paragraph 1-6.1. Report all discrepancies (para 1-3).

NOTE

Shortage of a minor assembly or part that does not affect proper functioning of the equipment should not prevent use of the equipment.

b. Checking Equipment for Damage. Inspect the equipment for damage incurred during shipment, as indicated below. Report all damaged equipment (para 1-3).

(1) Carefully inspect the components of the radiosonde recorder for evidence of dents or other damage.

(2) Inspect the contents of the accessories case for damage.

2-3. Siting

The ideal site for the operation of the radiosonde recorder is as close as possible to the rawin receiver with which it is used. To facilitate maintenance, provide a minimum access space of approximately 3 feet on the front, and 1 foot on the sides and rear of the recorder.

a. Select a distance from the operating location that will not exceed the length of interconnection and test cables to the radiosonde recorder.

b. Locate the radiosonde recorder it will be subjected to as little vibration as possible.

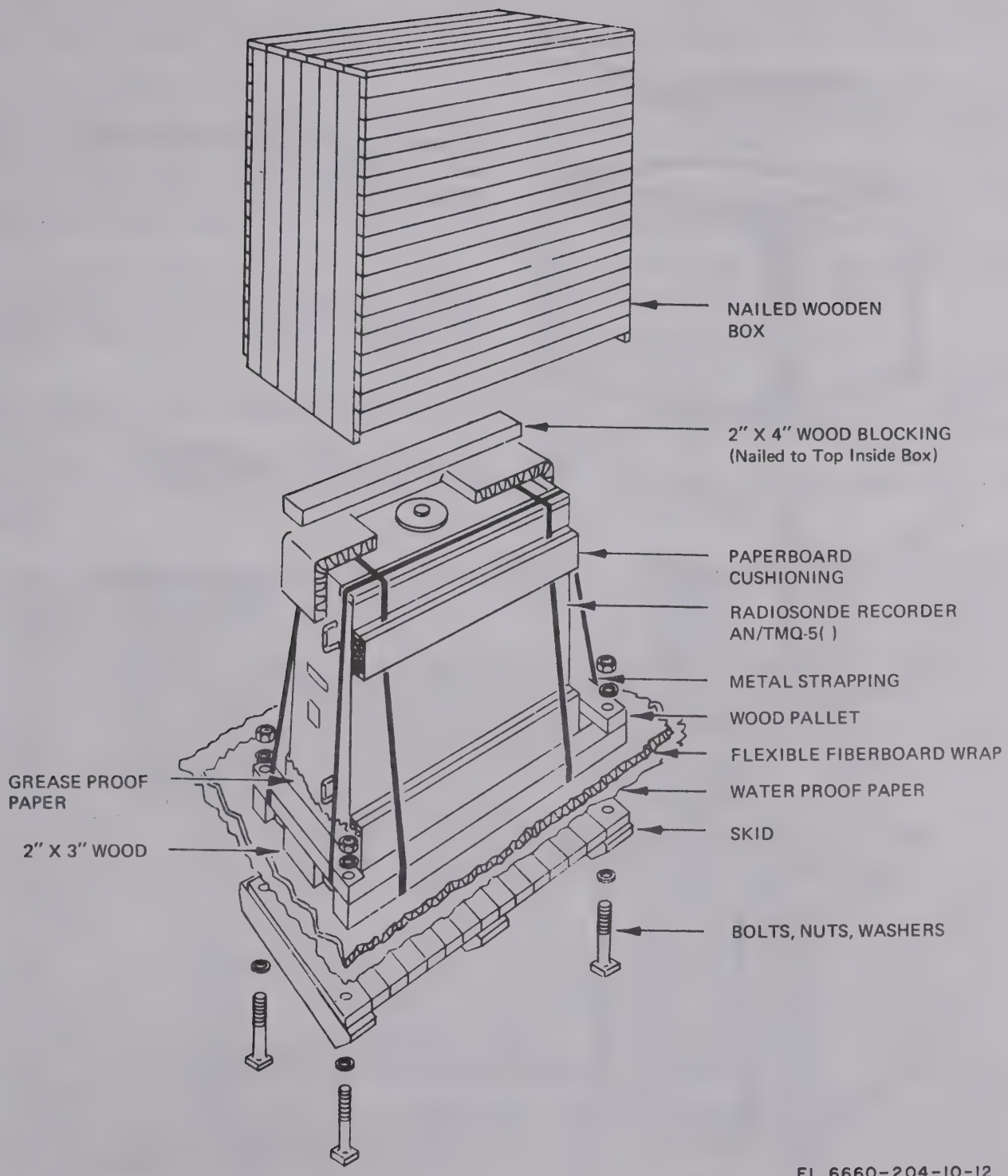


Figure 2-1. Packaging, Radiosonde Recorder AN/TMQ-5(*).

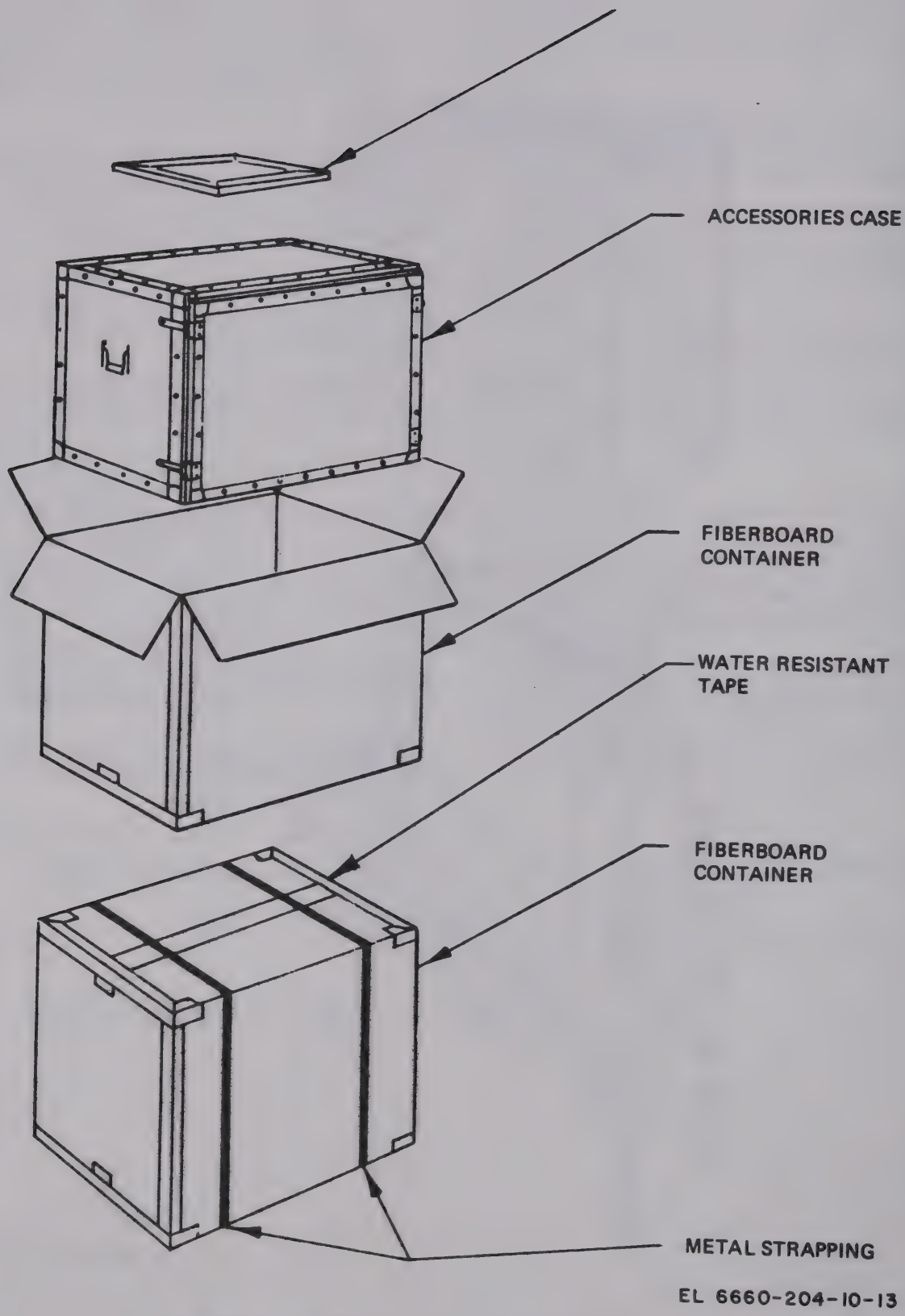


Figure 2-2. Packaging, Accessories Case CY-930/TMQ-5.

Avoid locations near electrical machinery, high-tension lines, and other electrical noise-producing equipment.

c. Select a reasonably quiet location to permit the monitoring loudspeaker to be heard.

d. Mount the radiosonde recorder on the accessories case or in Shop Van M–109 (para 2–9).

2–4. Shelter Requirements

The radiosonde recorder should be sheltered in a suitable enclosure, such as a tent or building, to provide environmental protection. Distance from the power unit is limited only by the availability of a suitable power cable.

2–5. Interconnections

Interconnections are made as part of the installation procedure and are described in paragraph 2–7.

2–6. Tools and Test Equipment Required for Installation

a. Tools. The tools necessary for unpacking and installing the radiosonde recorder are listed below.

(1) Hammer, claw.
(2) Nailpuller
(3) Cutting pliers.
(4) Knife.

b. Special Installation Tools.

(1) Two-inch screwdriver, H531, mounted in the frequency-time recorder chassis (figs. 2–3 and 2–4).

(2) Double-end wrench, H605 (¾ inch at one end and ⅞ inch at the other end (two supplied, fig. 1–7)). These wrenches are stored in the accessories case.

c. Test Equipment. There are no requirements for test equipment during installation.

d. Materials. All required materials are supplied and listed in the BILL (app. B).

2–7. Component Installation

a. After the equipment has been unpacked and a location selected, use the following procedure to install the components of Radiosonde Recorder AN/TMQ–5(*).

(1) Place the accessories case in the location selected for the installation.

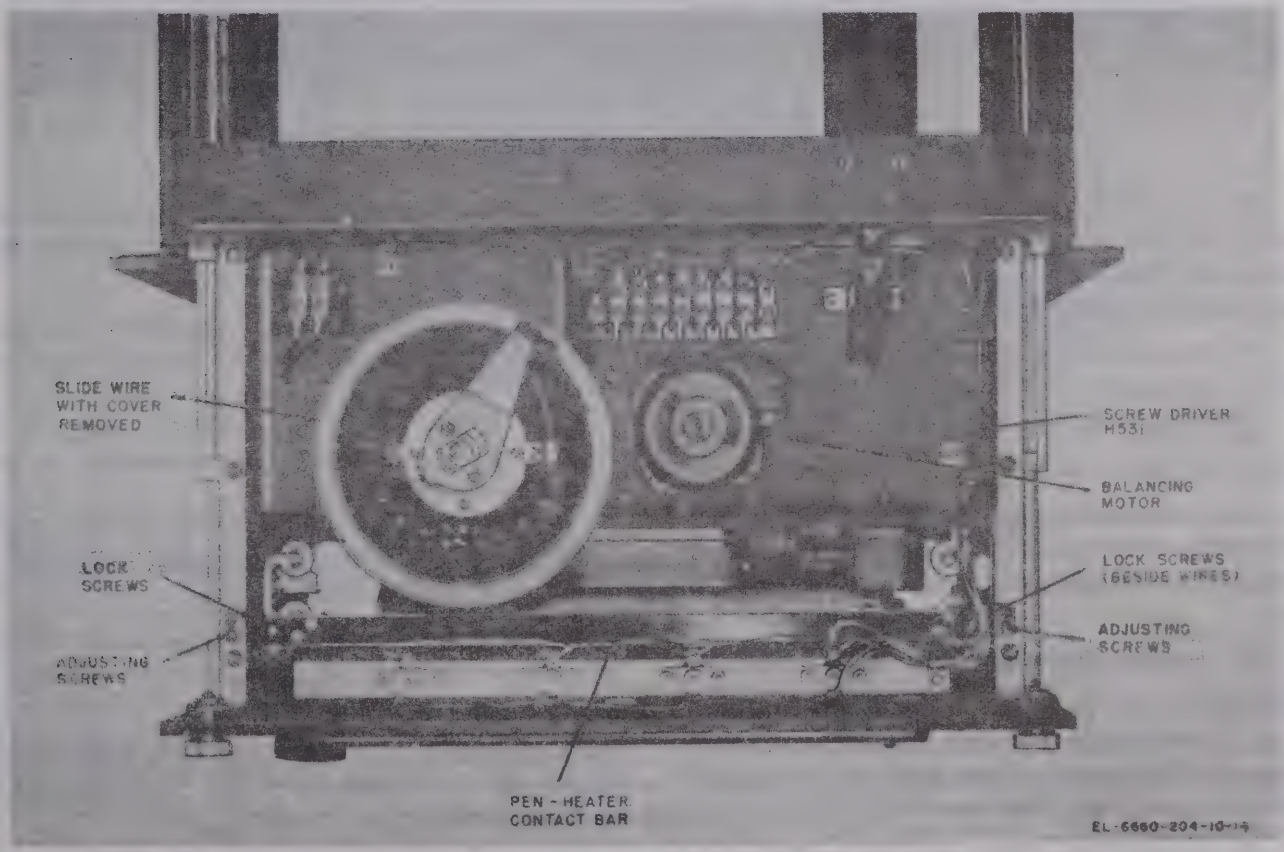


Figure 2–3. Frequency-Time Recorder RD–88/TMQ&5, top view.

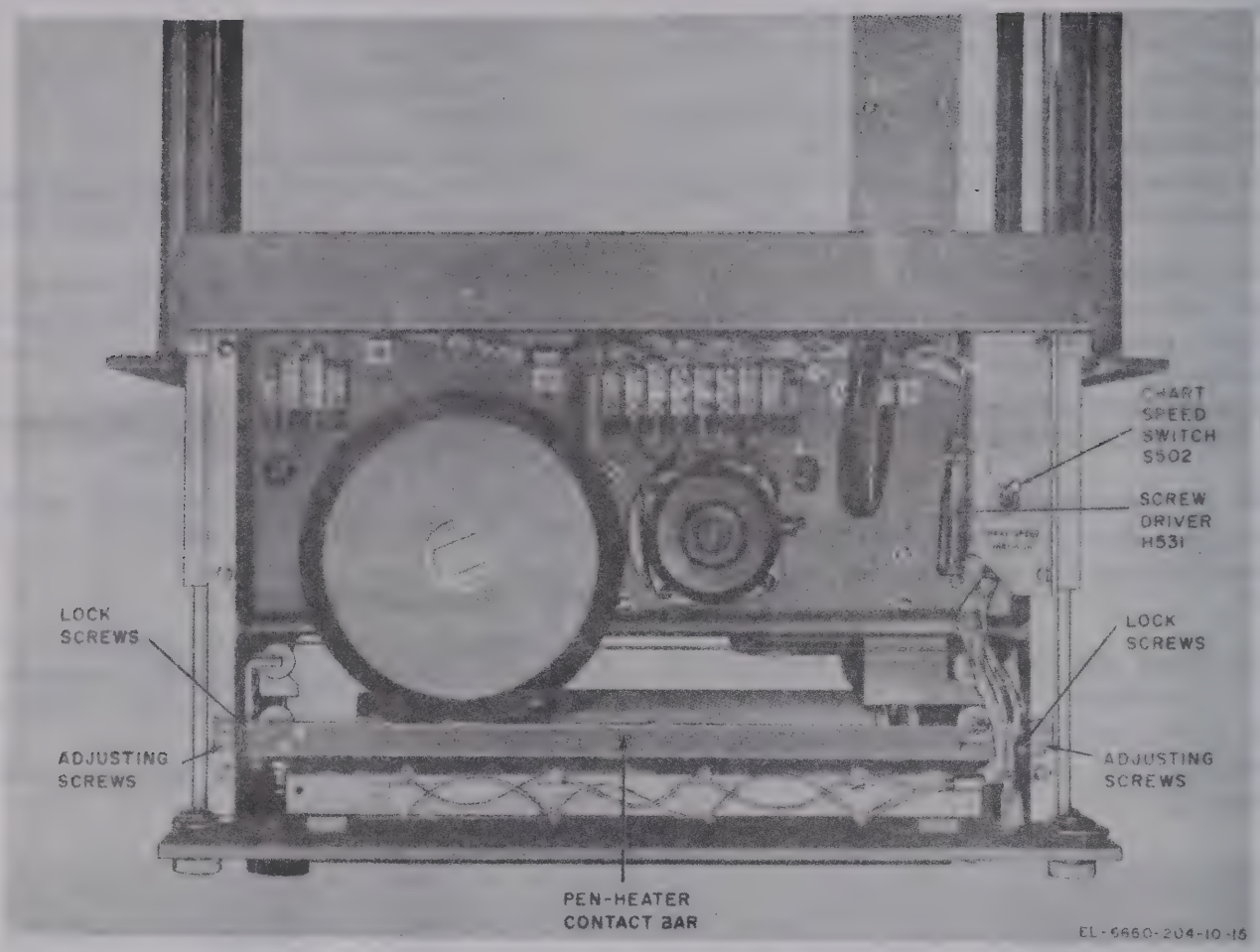


Figure 2–4. Frequency-Time Recorder RD–88A/TMQ–5, top view.

(2) Lift the radiosonde recorder to the top rear of the accessories case, and slide the recorder forward so that the shock mounts will fit under the bracket on top of the accessories case.

(3) Remove the wooden bar that secures the window latches of the frequency-time recorder.

(4) Loosen the two desk latches that secure the desk to the fan panel.

(5) Open the frequency-time recorder drawer by turning the two panel latch knobs (fig. 1–5) opposite to that of the arrows marked on the knobs.

(6) Remove the wooden bar from under the chart roller.

(7) Cut the lacing that holds the solenoid linkage and balancing motor gears on the underside of the frequency-time recorder.

(8) Remove the rear panel by unfastening the 12 Camloc fasteners.

(9) Remove the block of wood from under the power transformer (fig. 2–5) in the bottom of the cabinet.

b. Notify organizational maintenance that the following items (found in the accessories case) should be installed:

(1) Tubes V402, type 6Y6G; V409, type 6AS7G; V401 and V408, type 5R4WGY; in the power supply (fig. 2–5).

(2) Vibrator inverter G301 in the converter-amplifier chassis (fig. 2–5). Connect cable W301 to the top of the vibrator inverter.

c. Replace the rear of the cabinet.

2–8. Cable Installation

Radiosonde Recorder AN/TMQ–5(*) is used with Rawin Set AN/GMD–1(*) (fig. 2–6). Cable installation instructions are as follows:

a. Location of cables. Obtain cable W921 or Special Purpose Cable Assembly CX–1217/U and the

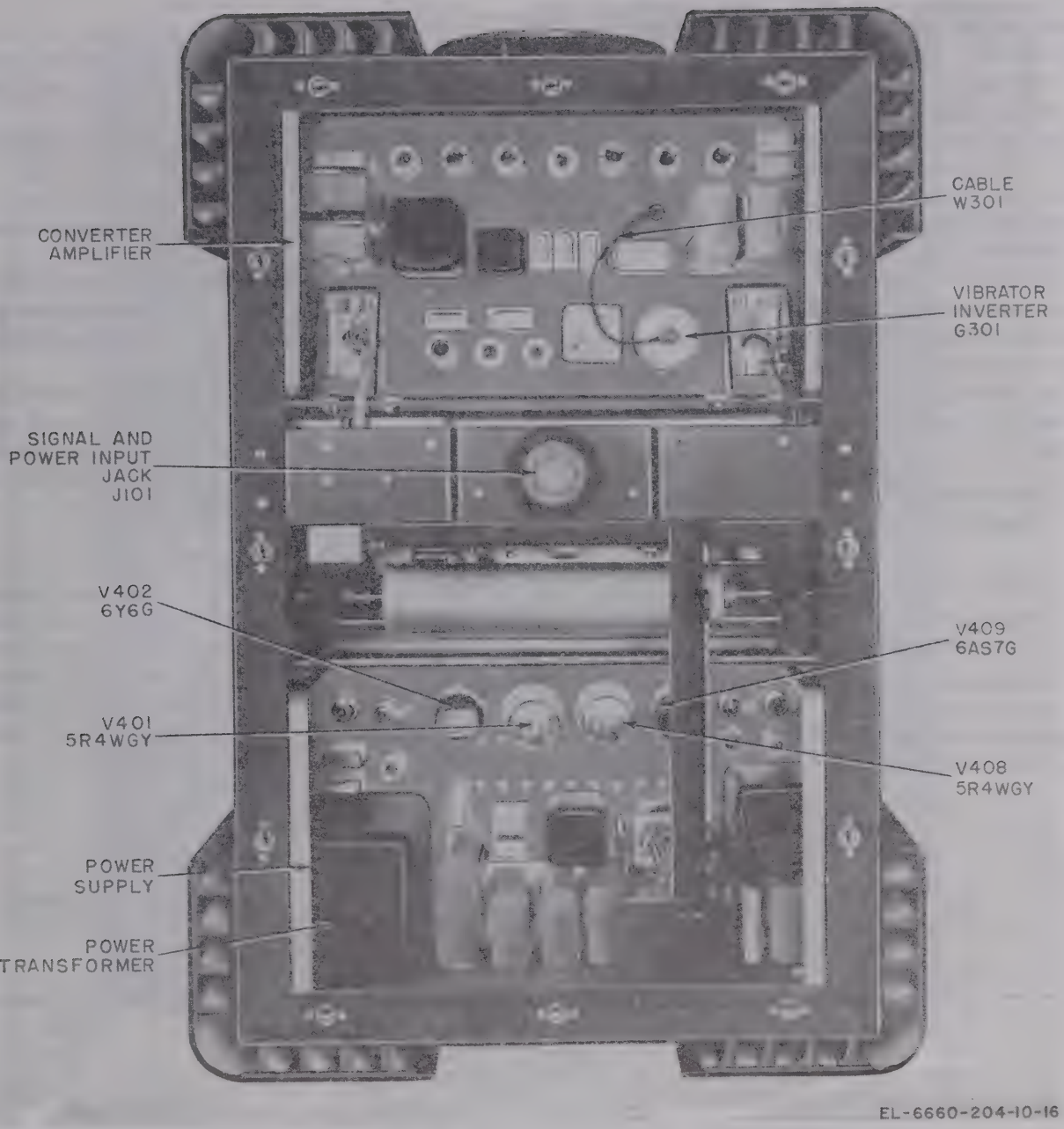


Figure 2-5. Radiosonde recorder, rear view.

meteorological cable adapter, which consists of the switchbox and a 5-foot length of coaxial cable; these are located in the accessories case of the rawin set.

b. Connections for Radiosonde Recorder AN/TMQ-5. Connect one end of Special Purpose Cable Assembly CX-1217/U to socket J101 of the radiosonde recorder, and connect the other end to J802 of Control Recorder C-577(*)/GMD-1 of the rawin set. In this installation, the primary power for the recorder is supplied through the rawin set. If the switchbox that operates the time-print mechanism of the control recorder is required in this installation, proceed as follows:

(1) Connect signal and power cable W601 to J101 of the radiosonde recorder.

(2) Connect the power cable branch of cable W601 to the ac power source (110 to 125 volts, 58 to 62 cps).

(3) Connect the signal cable branch of cable W601 to the 5-foot length of coaxial cable from the switchbox.

(4) Connect one end of Special Purpose Cable Assembly CX-1217/U into the switchbox, and the other end into J802 of the control recorder.

c. Connections for Radiosonde Recorder AN/TMQ-5A, AN/TMQ-5B, and AN/TMQ-5C (fig. 2-6). Connect Special Purpose Cable Assembly CX-1217/U between J101 of the radiosonde recorder and J802 of the control recorder. In this installation, the primary power circuit, signal circuit, and time-print circuit are completed through the special purpose cable. The operation of the time-print circuit is controlled either automatically or manually from the front panel of Frequency-Time Recorder RD-88A/TMQ-5.

2-9. Mounting Radiosonde Recorder in Shop Van M-109

NOTE

Before beginning the mounting procedures below, be sure to read the instructions thoroughly.

The operator is not permitted to install the support in the shop van. This is the responsibility of the organizational maintenance personnel. After Support MT-1355/TMQ has been installed, mount the radiosonde recorder as follows:

a. Remove the clamp strips from the horizontal arms (fig. 2-7) and lay the strips aside. Mount the arms on the upright members but do not tighten the nuts completely.

b. Remove the lower clamp strips from the support shelf and lay them aside.

c. Place the recorder (rear side to wall) on the shelf. Slide it back until it is against the angle stops on the shelf.

d. Slide the lower clamp strips through the bottom shock mounts and align the boltholes with those in the shelf. Insert the bolts and tighten the nuts securely.

e. Slide the upper clamp strips through the side section of the upper shock mounts and align the boltholes with those in the horizontal arms. Bolt the strips securely to the arms and tighten the nuts that hold the arms to the upright members.

2-10. Checking Installation

After installation of components and cables have been accomplished, check the mechanical security of all items installed (para 2-7); then check the cable connections (para 2-8). Do not apply power until initial adjustments (para 2-11 and 2-12) have been made and operating instructions (ch. 3) have been reviewed.

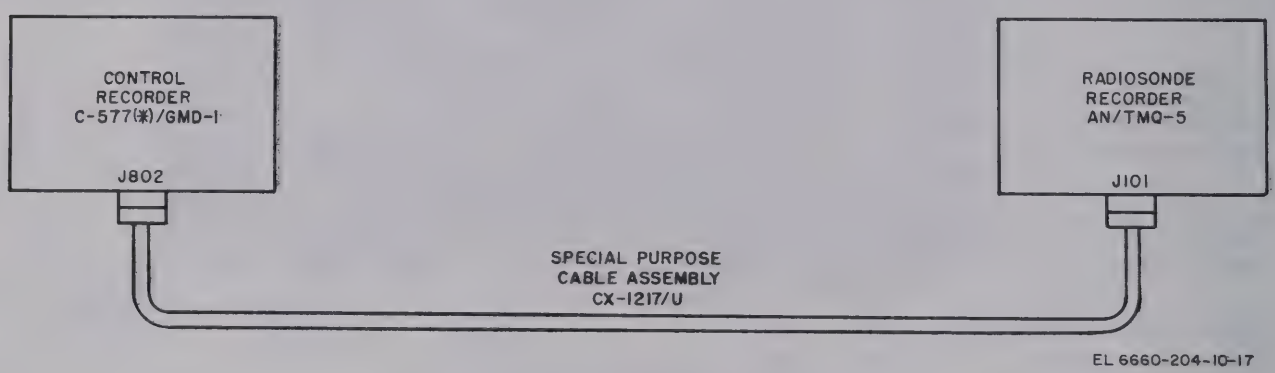


Figure 2-6. System connections.

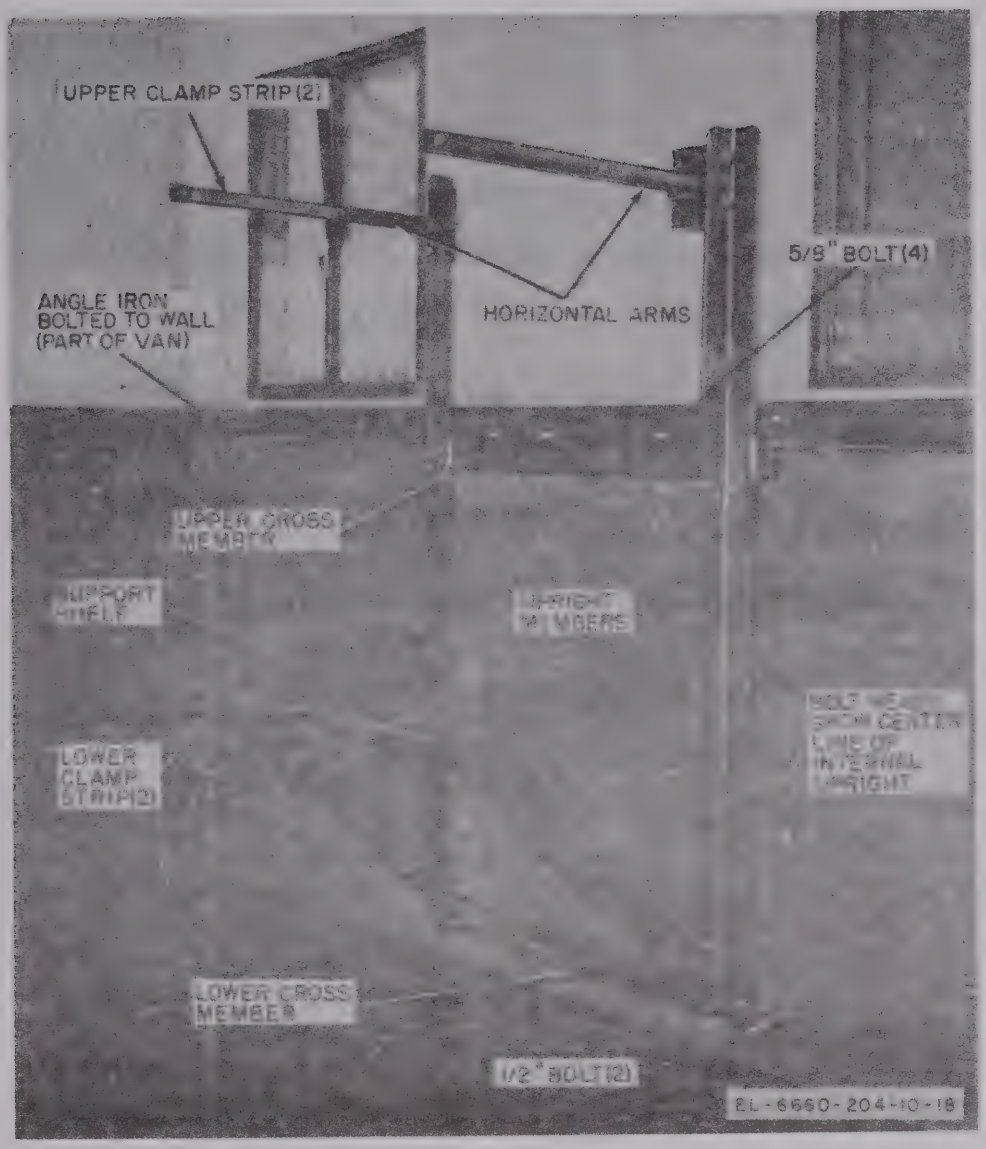


Figure 2–7. Support MT–1355/TMQ–5 mounted in Shop Van M–109.

Section II. INITIAL ADJUSTMENT OF EQUIPMENT

2–11. Leveling

Wherever mounted, the radiosonde recorder must be leveled as accurately as possible to prevent errors in calibration and recording. The use of a spirit level is necessary to accomplish this.

2–12. Operational Check Settings

Use the chart (para 3–2) as a checklist to determine the correct control settings and meter indications prior to operation.

CHAPTER 3

OPERATING INSTRUCTIONS

Section I. OPERATOR'S CONTROLS AND INDICATORS

3-1. Damage From Improper Settings

Haphazard operation or improper setting of the controls may cause damage to the electronic equipment and record inaccurate data; therefore, it is important to know the function of every control. The actual operation of the equipment is discussed in this chapter.

NOTE

To avoid improper actuation of control recorder time-print circuit, adjust radiosonde recorder reference control for recording reference signals in vicinity of 95 chart divisions (ordinates).

3-2. Controls and Indicators

The following chart lists the controls and indicators of the radiosonde recorder and the function of each item. The majority of the controls and meters are mounted on the control panel (fig. 3-1).

Control or indicator	Function
POWER LINE VOLTAGE meter (0 to 150 volts ac).	Indicates ac line voltage.
POWER LINE FREQUENCY meter (vibrating-reed type).	Indicates ac line frequency between 48 to 52 and 58 to 62 cps.
SIGNAL SELECTOR (switch).	In SIG. position, switch connects signal from radiosonde receiving system to input circuit of signal converter. In S.C. position, a short circuit prevents any signal from entering converter-amplifier. In 60 C.P.S. position, switch selects 60 cps voltage from T401 to be used as a signal for calibration and tests. In this position, pen marks chart at 30 ordinates (60 cps), if line frequency is 60 cps. In 120 C.P.S. position, switch selects 120 cps ripple voltage that is present at input; to filter circuit of positive power supply; this signal is used for calibration and tests. In this position, pen marks chart at 60 ordinates (120 cps) if line frequency is 60 cps.
SPEAKER VOL. control.	A potentiometer that adjusts audio level of monitoring speaker. Adjustment of this control has no effect on recorded signal. On some earlier units, control has switch that disconnects speaker, when control shaft is extreme counterclockwise.
POWER LINE circuit breakers.	Circuit breakers, one in each side of powerline, that are preset to open at 4 amperes.
POWER ON--POWER OFF STAND BY (power) switch.	Switch is in series with circuit breakers; when on, supplies power to the recorder system. In STAND BY position, power is applied to all circuits, except chart-drive motor and pen-lifting solenoid.
INTER S.C.-OUTPUT S.C. switch.	Used for localization of trouble. INTER S.C. position shorts any incoming signal at input to univibrator. OUTPUT S.C. position shorts any dc output voltage.
REC. TEST switch	During normal operation, this switch should be in the center position. Switch is momentary type, used to check operation of the frequency-time recorder. It disconnects signal from signal converter and substitutes test voltage.

Control or indicator	Function
REF. ADJUST knob	Vernier potentiometer that may be rotated through 10 revolutions. Adjust the pen position for exact recording of the low reference signal during the ground check.
Power indicator lamp	Lights when power switch is in POWER ON or STAND BY position.
FAN switch (fig. 1–6)	Mounted on the fan panel: controls operation of fan.
Manual chart advance knob (fig. 3–5).	Unmarked control, mounted at the left side of chart roller; advances chart manually.
CHART SPEED INS/MIN. ½–1 (chart speed) (fig. 2–4) (in RD–88A/TMQ–5 and RD–88B/TMQ–5 only.)	Chart speed switch allows manual selection of chart speed, shown by panel marking. It is not included in first model of the recorder (RD–88/TMQ–5).
Rawin time-print AUTO-OFF-MAN (fig. 3–5).	In OFF position, switch causes printed time record from Control Recorder C–577 (*)/GMD–1 to occur at regular predetermined rate, as selected by position of controls on control recorder. In MAN. position (momentary), an additional time-print is recorded by control recorder.
	In AUTO. position, an additional time-print is recorded by control recorder each time upward excursion of pen reaches 90 ordinates on the scale. These additional time-prints of control recorder are distinguished by an asterisk, which is also printed when time-print only circuit is energized.
CHART SPEED pushbuttons (RD–88C/TMQ–5 only, fig. 3–2).	Allow manual selection of 3 possible chart speeds (½, 1, or 2 inches per minute).
SENSITIVITY control (screwdriver-adjusted) potentiometer.	Controls gain of servo amplifier.
REC. ZERO control (screwdriver-adjusted) potentiometer.	Aligns recorder pen on zero when SIGNAL SELECTOR switch is in S.C. position.
REC. TEST ADJ. control (screwdriver-adjusted) potentiometer.	Select amount of necessary voltage to make pen indicate 95 on sclae, when REC. TEST switch is depressed.
PEN LIFTER control (screwdriver-adjusted) potentiometer.	Control amount of voltage fed by power amplifier tubes on pen-lifter circuit.
OPERATE-LOCK control	In LOCK position, this control clamps pen carriage rod, and prevents pen from touching paper or vibrating.

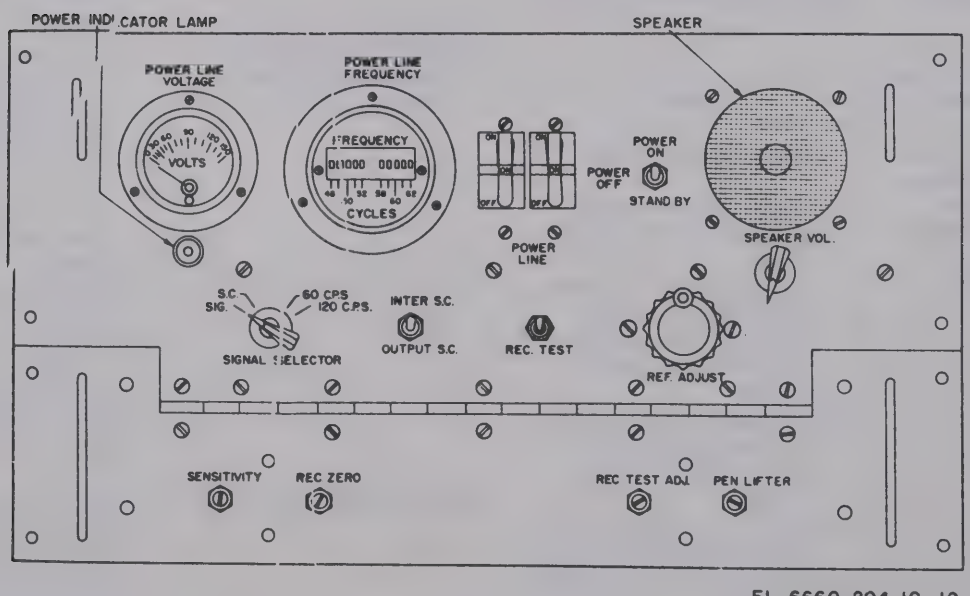


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Figure 3–1. Control Panel C–834/TMQ–5, front view.

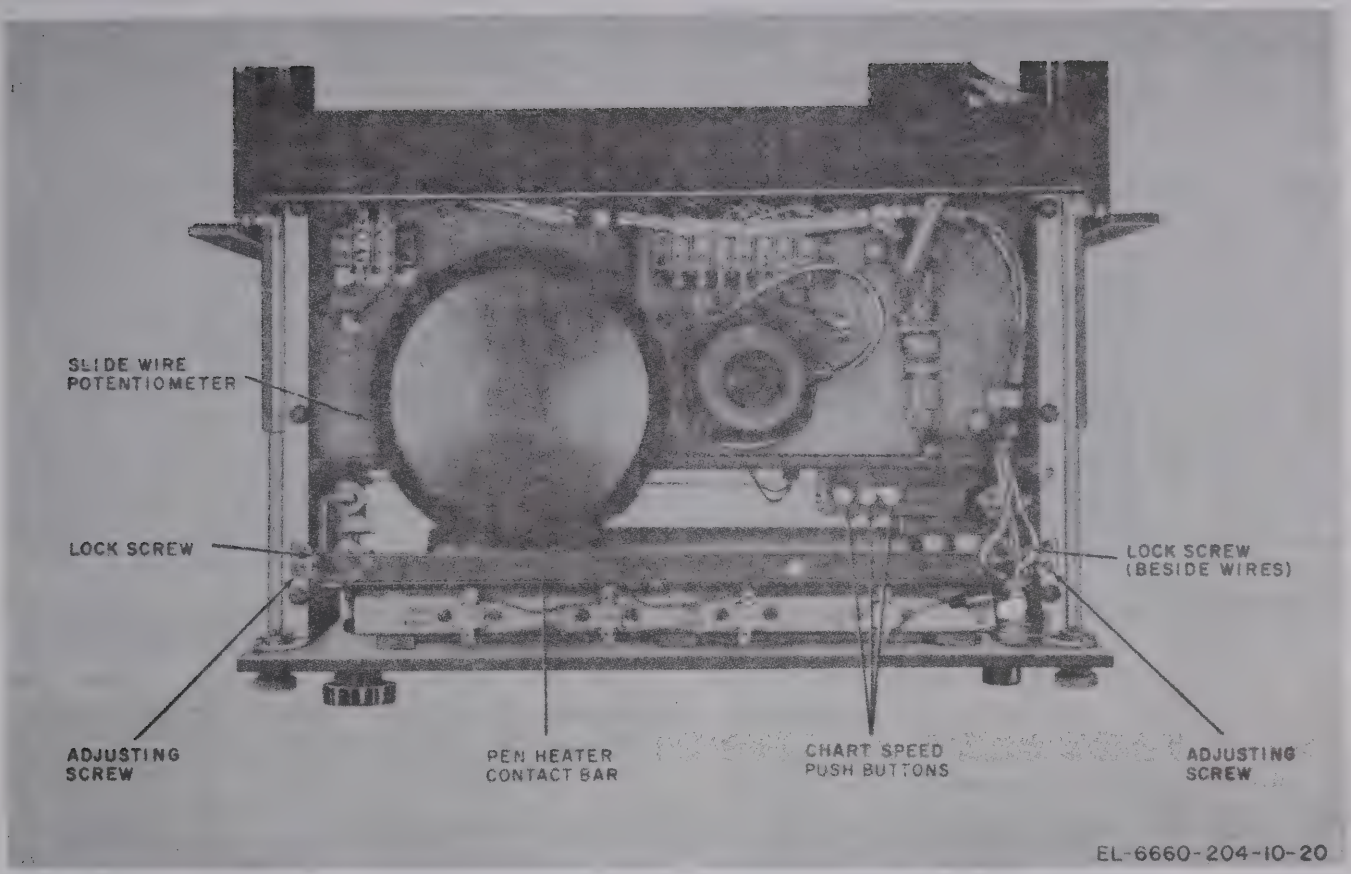

Figure 3-2. Frequency-Time Recorder RD-88C/TMQ-5, top view.

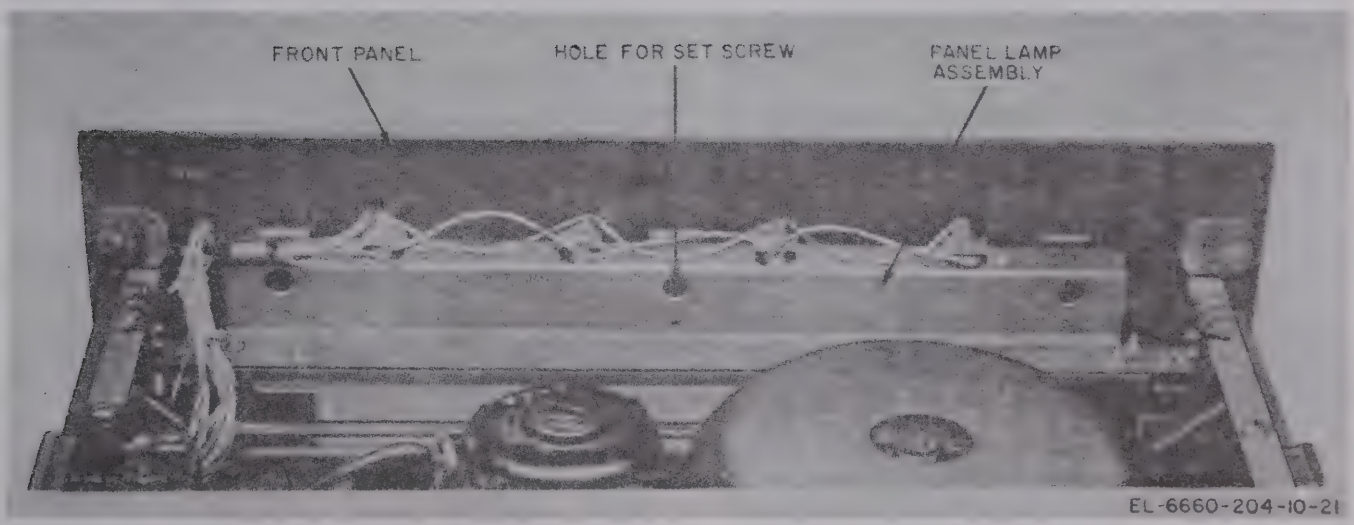

Figure 3-3. Frequency-Time Recorder, RD-88C/TMQ-5, rear of panel.

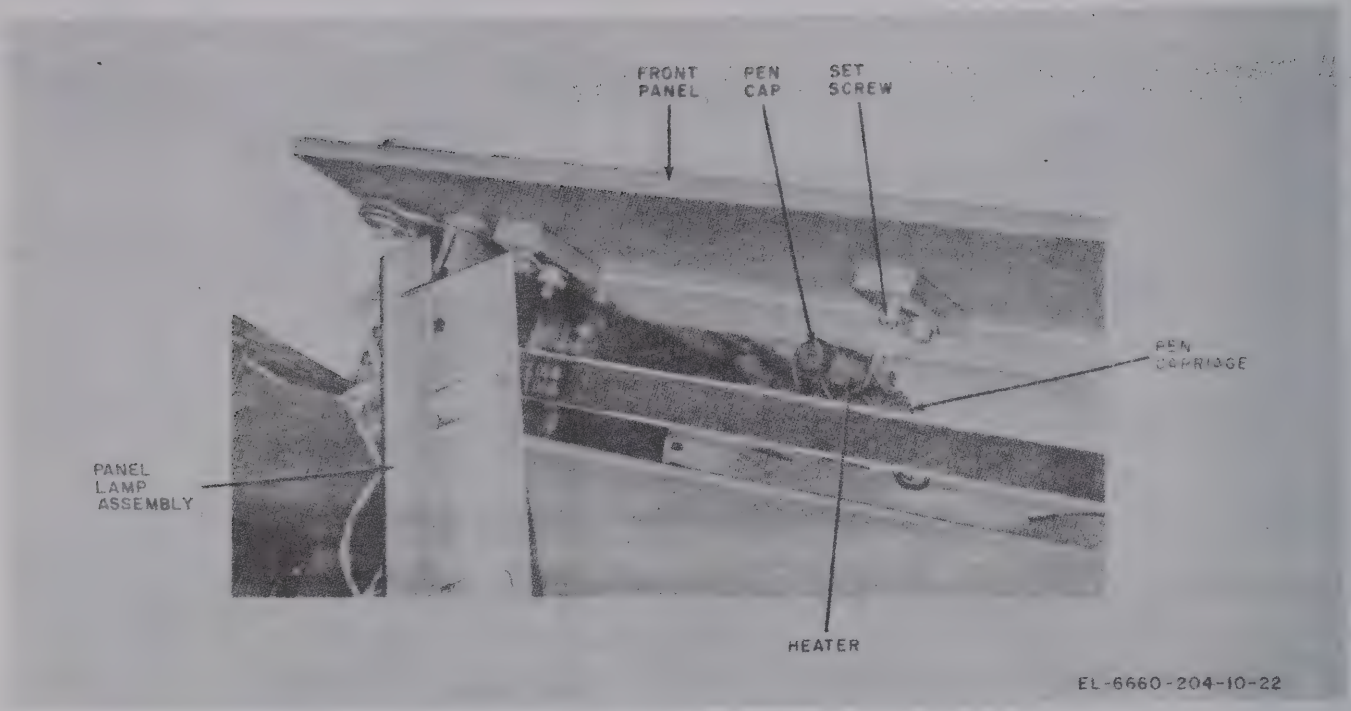

Figure 3-4. Pen assembly.

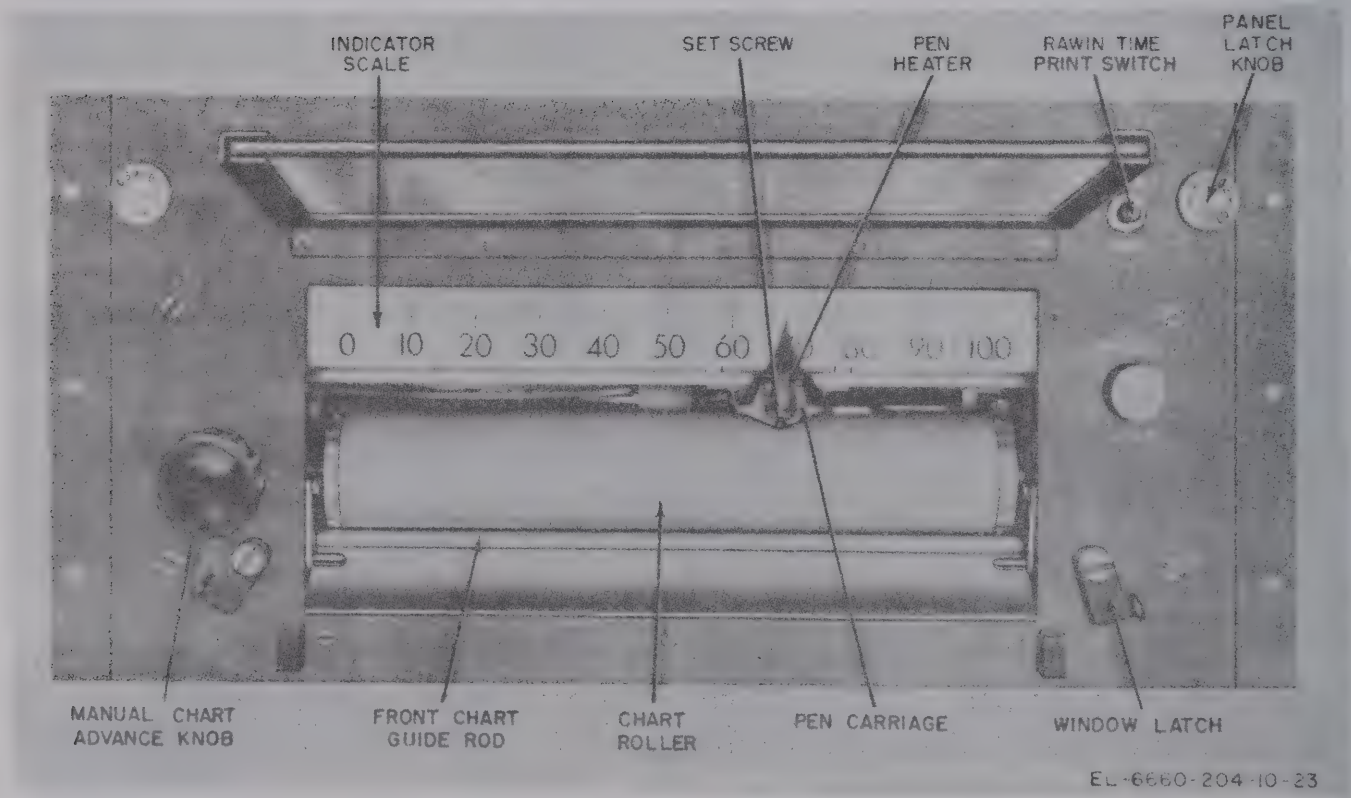

Figure 3-5. Frequency-Time Recorder RD-88/TMQ-5, front view.

Section II. PRELIMINARY PROCEDURES

3-3. Filling Pen

Use the following procedure to fill the pen. (During shipment, the pen is in the accessories case.)

a. Open the frequency-time recorder drawer and remove the screwdriver (figs. 2-3 and 2-4) from the right-hand side of the chassis. Loosen the setscrews that secure the panel lamp assembly (fig. 3-3). Do not remove the setscrews. Raise the panel lamp assembly and lay it to one side (fig. 3-4).

b. Open the recorder window to loosen the small setscrew in front of the pen carriage (fig. 3-5).

c. Carefully raise the pen from the pen carriage and unscrew the pen cap (fig. 3-4). Slide the pen heater from the pen barrel; be careful not to break the pen heater connecting wires.

d. While holding the pen in the left hand at approximately a 45° angle, insert the spout of the ink tube into the pen barrel until the spout touches the bottom. Squeeze the tube until the barrel is three-fourths full of ink. This method will force out air bubbles in the ink chamber.

e. Replace the pen heater and pen cap. Be sure the venthole in the cap is not clogged.

f. Replace the pen in the pen carriage; be sure the pen is seated firmly, and the barrel is in a vertical position.

g. Tighten the setscrew and dress the pen heater leads away from the carriage shaft and indicator scale. Close the radiosonde recorder window.

h. Replace the panel lamp assembly and tighten the setscrews to secure the panel lamp assembly.

i. Replace the screwdriver (fig. 2-3) and close the frequency-time recorder drawer.

3-4. Actuating Pen Heater

(fig. 2-3)

a. To prevent the ink from freezing, a heating wire element is wound around the pen barrel. This heater is automatically turned on and off, as required, by a thermostat. Because the pen must cover too great a distance for flexible feed wires to be practical, a trolley system (pen-heater contact bar) is installed to supply electrical power to the heater element. Such a feature is unnecessary in warm weather. To allow the pen to move freely throughout its excursion, the trolley system is lowered into position to make contact only when weather conditions demand. The thermostat is located at the right-hand end of the pen-heater contact bar.

b. If the temperature drops to 40° F or below, lower the contact bar to make contact with the moving contactors mounted on the pen carriage. The adjusting screws on top of the bar are factory-adjusted, and should not be changed unless necessary. Loosen the two lockscrews on each end of the bar, and allow the bar to drop as far as the adjusting screws permit. Check the sliding contacts of the pen heater by sliding the pen carriage from one end of the scale to the other, first in the up position of the pen and then in the down position. While sliding the pen carriage, be sure that the sliding contacts make good electrical contact throughout the excursion. Tighten the lockscrews.

3-5. Chart Installation

a. Step 1.

(1) Release the panel latch knobs (fig. 3-5). Pull the frequency-time recorder chassis forward.

(2) Release the two window latches, and open the frequency-time recorder window.

(3) Pull the front chart guide rod forward (away from the chart roller).

(4) Push back the spring-loaded intermediate chart guide rod (fig. 3-6). The right and left ends are accessible behind the lower portion of the front panel.

(5) Loosen the right-hand knurled screw that holds the tear-off scale (fig. 1-4) to the writing desk.

(6) While holding the writing desk, remove the writing desk by withdrawing the two spring-loaded knurled rods at the ends of the hinge axis.

b. Step 2.

(1) Unwind about 2 feet of the new chart roll.

(2) With the printed side up, place the core of the chart roll over the right rear chart roll bearing (fig. 3-6). This bearing is spring-loaded and must be compressed to the right to follow the directions given in (3) below.

(3) Place the left end of the chart roll over the left rear chart roll bearing. Be sure to engage the guide pin on the bearing with the core slot.

(4) Feed the chart under the rear and intermediate chart guide rods.

(5) Feed the chart over the chart roller and under the front chart guide rod (fig. 3–5). Engage the punched guide holes on the left side of the chart paper with the teeth on the roller.

(6) Check to be sure that the horizontal line of the chart is parallel with the front chart guide rod.

(7) Check to see that the paper is against the chart guide collar located on the intermediate guide rod; then push this guide rod (both sides) and the front guide rod into their respective operating positions.

NOTE

If only one side of the intermediate chart guide is engaged, the chart paper will not feed correctly.

(8) Replace the writing desk.

c. Step 3.

(1) Close the recorder window, and secure the window latches.

(2) Rotate the manual chart advance knob and slide the frequency-time recorder back into position, and lock the panel latch knobs.

(3) Slide the chart paper under the tear-off scale, and aline the scale graduations with the chart graduations by laterally positioning the tear-off scale. Then tighten the right-hand knurled screw that holds the tear-off scale to the desk.

(4) Place the chart weight (fig. 1–7) on the chart with the knurled thumbscrews toward the front.

NOTE

As the chart advances, the chart weight will move toward the floor. Release the clamping pressure of the chart weight and slide it up toward the desk. If the weight tends to slip on the paper, use a small paper shim to increase the thickness between the clamping bars. Do not use pliers on the knurled nuts. If the weight is not added to the chart, the intake of the fan assembly (located below the writing table) will hold the paper against the cabinet and may cause the chart roll to jam in the frequency-time recorder.

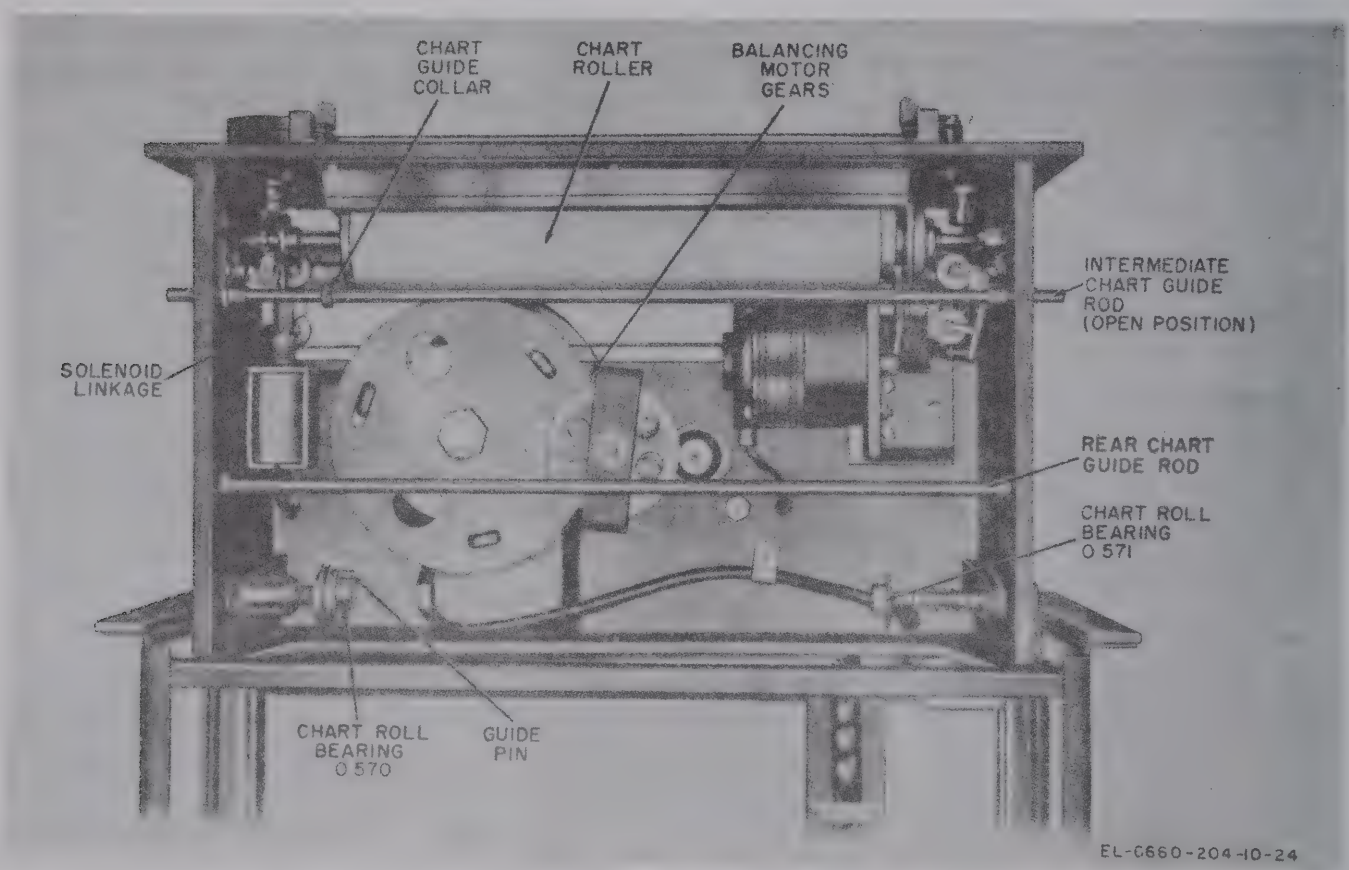

Figure 3–6. Frequency-Time Recorder RD–88/TMQ–5, bottom view showing main chart drive items.

Section III. OPERATION UNDER USUAL CONDITIONS

3-6. Preparatory and Presetting Procedure

a. Prepare the radiosonde recorder for operation; refer to the applicable publication for the radiosonde, listed in appendix A.

b. Prepare the rawin set; refer to the applicable publication for the rawin set, listed in appendix A.

c. Check to be sure that installation has been properly accomplished (para 2-7) and cables have been properly connected (para 2-8).

d. Check to be sure hat the pen is full; if filling is required, refer to paragraph 3-3.

e. Check to be sure that there is sufficient reserve chart for the anticipated operating time. Footage markers are located on the side of the recorder roll-chart. At least 5 feet of chart is required for a flight. If chart installation is required, refer to paragraph 3-5.

f. Open the vent on top of the cabinet by running the knurled knob counterclockwise until it is loose. Spring action will open the cover.

g. Unfasten the two desk latches, and place the desk in the inclined position by pulling the bottom edge of the desk forward.

h. Check the chart feed mechanism for smooth movement and drift-free feed by turning the manual chart advance knob clockwise. Instructions to correct any drift are given in paragraph 4-12.

i. Set the power switch to POWER OFF.

j. Operate the SIGNAL SELECTOR switch to S.C.

k. Place the two POWER LINE circuit breakers to ON.

l. Deleted.

m. Deleted.

n. If the frequency-time recorder is type RD-88A/TMQ-5 or RD-88B/TMQ-5, operate the CHART SPEEDS switch to the desired position. In Frequency-Time Recorder RD-88C/TMQ-5, press the push-button corresponding to the speed desired (1/2, 1, or 2 inches per minute).

o. If the RD-88A/TMQ-5 or RD-88B/TMQ-5 is used, operate the rawin time-print switch to the AUTO. or OFF, as desired.

3-7. Preliminary Starting and Warmup Procedure

After the presetting procedure (para 3-6) has been accomplished, perform the following preliminary starting and warmup procedure:

a. Deleted.

b. Set the power switch to STAND BY.

c. Read the POWER LINE FREQUENCY and POWER LINE VOLTAGE meters. If the frequency is not stable at a value between 50 to 65 Hz, and the voltage is not between 105 and 125 volts, the performance of the equipment will be affected. If the voltage is normal, but the frequency is not, determine the line frequency from the POWER LINE FREQUENCY meter. When the frequency is some value other than 60 Hz, the frequency of the test voltage is available through the SIGNAL SELECTOR switch also will be different. The 60 C.P.S. position of the switch will deliver a frequency that is equal to the powerline frequency, and the 120 C.P.S. position will deliver a frequency that is equal to twice the powerline frequency. The chart readings for these frequencies will vary accordingly.

d. Set the FAN switch to ON. Allow approximately 10 minutes for the recorder to warm up.

e. Place the OPERATE-LOCK control in the OPERATE position.

f. Ensure that the INTER S.C.-OUTPUT S.C. switch is in the center position.

3-8. Starting Procedure

NOTE

The values discussed below are the normal operation under normal powerline conditions. If an abnormal result is obtained, refer to qualified maintenance personnel.

a. After the warmup period, set the power switch to POWER ON. The pen should record at zero on the chart (the SIGNAL SELECTOR switch still in S.C. position). If the pen does not record at zero, rotate the REC. ZERO control until the pen does record at zero.

b. Hold the REC. TEST switch in its down position; the pen should go to 95 ordinates and mark the chart. If the pen does not go to 95, rotate the REC. TEST ADJ. control until the pen does go to 95. Release the switch, and the pen should return to zero and again mark the chart.

c. Rotate the SIGNAL SELECTOR switch to 60 C.P.S. The pen will go to 30 ordinates on the chart, or will be adjustable to 30 by rotating the REF. ADJUST. (This reading is one-half the line frequency). A 60-Hz signal is heard in the speaker. Adjust the SPEAKER VOL. to obtain the desired loudness from the speaker. If REF. ADJUST control setting was changed, recheck REC. TEST.

d. Rotate the SIGNAL SELECTOR switch to 120 C.P.S. The pen will travel to 60 graph divisions (ordinates) on the chart, or will be adjustable to 60 divisions by rotating the REF. ADJUST knob; a 120-Hz signal will be heard in the speaker.

e. Rotate the SIGNAL SELECTOR switch to

SIG. The radiosonde recorder is now ready to receive and record signals.

3-9. Sensitivity Check

Recorder sensitivity is the ability of the radiosonde recorder to respond and return to the same ordinate value when recording small data changes, either upscale or downscale on the chart. The sensitivity of the radiosonde recorder affects the baseline check; therefore, a sensitivity record check will be made prior to a baseline check and will not be changed during or after the baseline check.

a. The operator will perform the following in sequency to record the sensitivity check.

(1) Rotate the SIGNAL SELECTOR switch to 60 C.P.S.

(2) Using the REF. ADJUST control, move the pen upscale on the chart to a value 5 to 10 ordinates higher than that obtained in the 60 C.P.S. check. Record the pen traces for approximately 10 seconds.

(3) Rotate the SIGNAL SELECTOR switch to S.C.; momentarily move the pen downscale (do not allow the pen to reach the end of the scale).

(4) Return the SIGNAL SELECTOR switch to 60 C.P.S.; record the pen trace for 10 seconds.

(5) Press the REC. TEST switch; momentarily move the pen upscale (do not allow the pen to reach 91 ordinates), release the REC. TEST switch, and record the pen trace for 10 seconds.

(6) Repeat the procedures in (1) through (5) above until three or more traces on each side of the rest point have been recorded.

(7) The recorder should operate at maximum sensitivity with no indications of instability or hunting.

(8) If the operator cannot obtain a sensitivity check of 0.2 ordinates or better by adjusting the SENSITIVITY control and repeating the above tests, maintenance personnel will be notified to perform a sensitivity calibration check.

b. When the sensitivity check has been completed, turn the REF. ADJUST control until the pen is recording on 30 ordinates or to a position equal to one-half of the line frequency, then rotate the SIGNAL SELECTOR switch to the S.C. positions; the pen should return to zero. The zero check trace should be at least 1/2 inch long.

c. A record of the sensitivity check and zero check will be included as part of the recorder record for each radiosonde observation. A linearity calibration test will be performed by qualified maintenance personnel and a linearity calibration correction chart will be constructed at least each 30 days. This procedure is covered in detail in TM 11-6660-204-25.

3-10. Evaluation of Ground Check (Baseline (Check)

a. Baseline Check. The baseline check is required to establish a relationship between radiosonde transmitted value of temperature and humidity (recorded in terms of ordinates values) and observed values of temperature and humidity (read from the psychrometer upon completion of the baseline check). The temperature-humidity ordinate relationship is necessary to convert the ordinate values of temperature and humidity, recorded during the flight, to actual temperature and humidity. It is important that a satisfactory baseline check be accurate or the values obtained during flight are not valid.

b. Temperature and Humidity Requirements in Baseline Check Box. The relative humidity in the baseline check set should fall within 20 to 70 percent. If the relative humidity does not fall within this range, refer to TM 11-6660-219-12 for humidity control procedures. The temperature should be stable within $\pm 5°C$ and the humidity stable within $\pm 5\%$ during a 5-minute period.

c. Recorder Traces. The radiosonde set is automatically switched through the cycles of reference, temperature, and humidity in the following order: low reference, temperature, low reference, humidity, and repeat. When the temperature and humidity traces are recording near the same ordinate value, the operator must remember that the temperature trace follows after the low reference trace.

NOTE

Switching, using manual operation, will be made in the same sequence listed above when necessary.

d. Evaluation Requirements. Adjust the first low reference to read 95.0 ordinates, and each successive low reference trace to 95.0 ordinates, until the requirements listed below are met.

(1) The upper left edge of all low reference traces must be recorded at 95.0 ordinates without adjustment of controls. If an adjustment is made, a new series of traces for temperature and humidity will be required.

(2) Relative humidity traces must be aligned so a line connecting the top left edge of the last two traces is parallel with the ordinate value, or three consecutive traces must show a trend in the same direction, and the three traces must fall on a straight line, covering no more than 0.3 of an ordinate spread.

NOTE

If a manual baseline check is made, the three consecutive traces must fall in a straight line covering not more than 1 ordinate.

(3) Temperature traces must be aligned so that a line connecting the left top edge of the last two traces is parallel with the ordinate value.

NOTE

If a manual baseline check is made, the last three consecutive traces must show a trend in the same direction and cover no more than 0.5 of an ordinate.

e. Evaluation of Ground Check (Baseline).

(1) Advance the chart manually, if necessary, and draw a horizontal line across the radiosonde recorder record parallel to the horizontal lines printed on the paper and at the top of the last baseline relative humidity trace.

(2) Draw straight lines connecting the top left-hand edges of temperature, humidity, and low reference traces to make them continuous plots (fig. 3–7).

(3) At the tenth ordinate on the horizontal line, enter the notation BASELINE CHECK (fig. 3–7) followed by the Greenwich Mean Time (GMT) time (to the nearest whole minute) of the completion of the baseline check.

(4) Read the temperature ordinates to the nearest tenth and enter the value on the horizontal line immediately to the right of the line connecting the left edge of the temperature traces. Following the temperature ordinate, if frequency-time recorder correction is necessary, enter an equal sign and the corrected temperature ordinate value. Enter another equal sign followed by the baseline check dry bulb temperature value. *Example*: 71.5–0.1 = 71.4 = 23.6° C.

(5) Read the humidity ordinate value at the intersection of the horizontal line and the line connecting the left edges of the humidity traces. Enter this value below the horizontal line under the temperature ordinate value, followed by the applicable recorder correction, if necessary, an equal sign, and the corrected ordinate. Enter another equal sign, followed by the baseline check psychrometric humidity value. Enter all values in parentheses as shown in the following example: (77.3–0.3 = 77.0 = 34%).

(6) Use the values for temperature and humidity for the lock-in of Computer, Humidity-Temperature CP–223C/UM.

3–11. Final Preflight Procedure

a. Preparation. Prepare the radiosonde set for launching; refer to the applicable publication for the radiosonde set as listed in appendix A.

b. Release Procedures. When a fast rising balloon is used with Radiosonde Recorder AN/TMQ-5A or B, place the chart speed switch in the 1 position (1 inch per minute). When Radiosonde Recorder AN/TMQ–5C is used, select by push-button, either the 1 or 2 inches per minute paper feed.

(1) Make a visual check of the radiosonde balloon train.

(2) Place RECORDS CONTROL switch on the control recorder to STANDBY.

(3) Turn the radiosonde recorder SIGNAL SELECTOR switch to the SIG. position. Insure that the power switch is set to POWER ON position.

(4) Place the rawin time print switch in the AUTO. or MAN. position as desired.

(5) When the operator at the radiosonde recorder is satisfied with the operation, signal the observer to release the radiosonde balloon train.

c. Marking Release. The operator of the radiosonde recorder

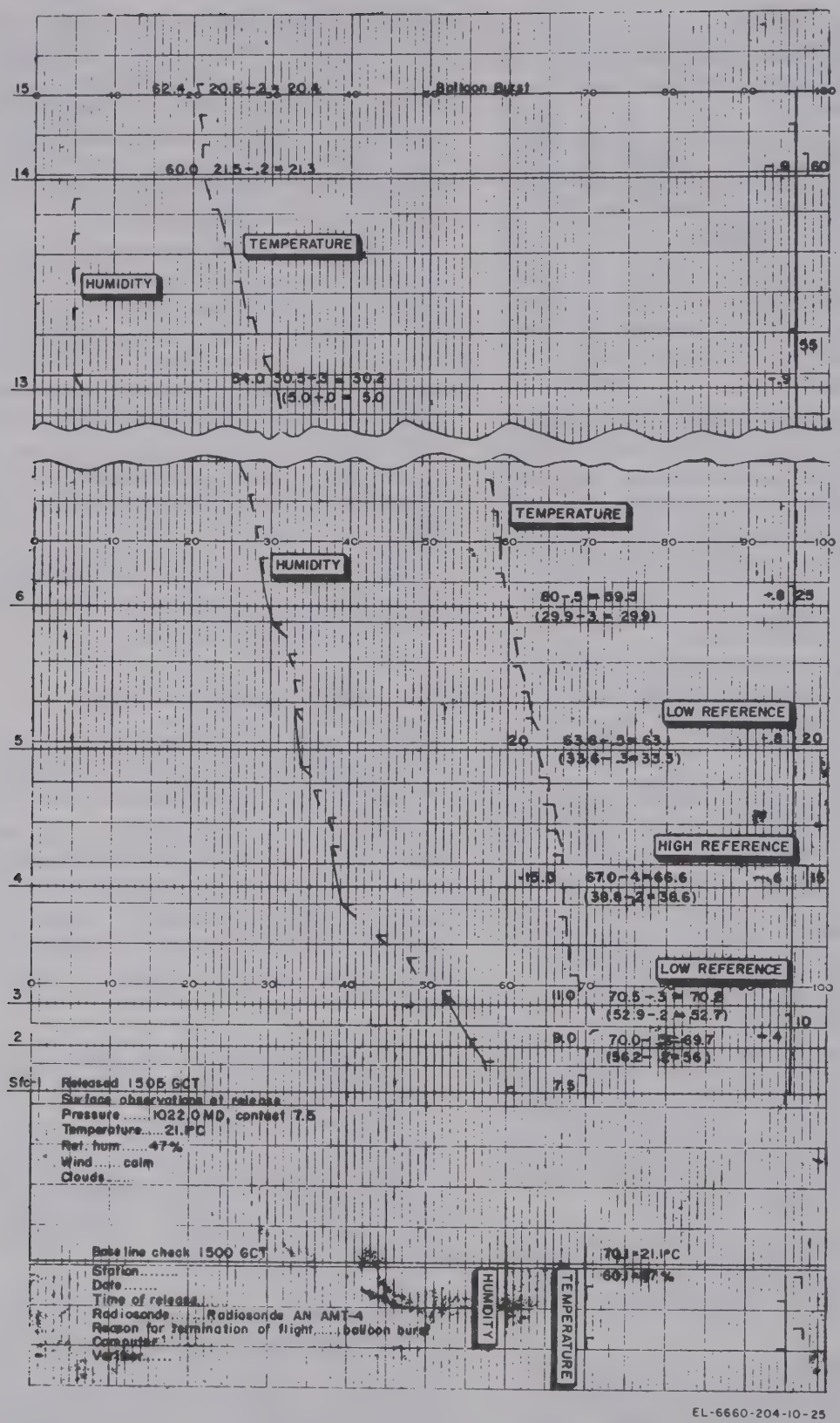

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Figure 3-7. Sample of flight record for Radiosonde Sets AN/AMT-4, AN/AMT-4A, and AN/AMT-4B.

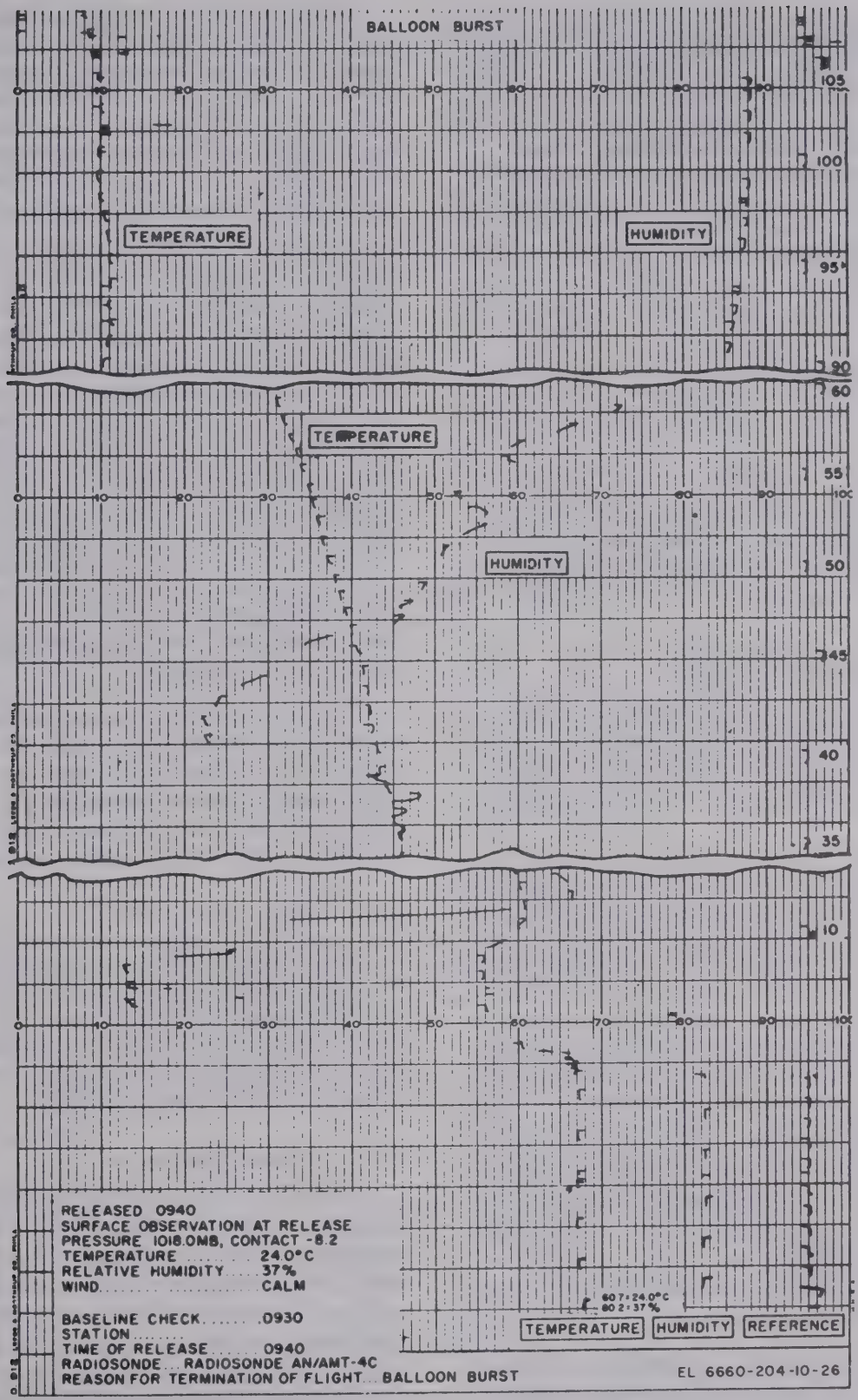

Figure 3-8. Sample of flight record for Radiosonde Sets AN/AMT-4C and AN/AMT-4D.

will mark the frequency-time recorder graph record by turning the radiosonde recorder SIGNAL SELECTOR switch back to the SIG. position at the exact moment of release. Turn the rawin RECORDS CONTROL switch on the control recorder to the ON or FLIGHT position at the moment of release, and note the release time.

NOTE

For further details on launching other types of balloons with radiosonde sets, refer to the applicable publications listed in appendix A.

3–12. Operating Procedure

a. As each low reference signal is received, note whether the trace is being recorded clearly; then, if required adjust the low reference to 95.0 graph divisions (ordinates) with the REF. ADJUST knob.

(1) Insure that the adjustment is completed and a portion of the adjusted trace is recorded before the signal switches to a temperature trace.

(2) The low reference will never be adjusted before the trace needing adjustment is recorded.

(3) If the ascension rate is fast and the recorded low reference traces are too short to provide a readable record, both before and after adjustment, no adjustment will be made.

(4) If the reference trace was adjusted to 95.0 graph divisions (ordinates) and the temperature trace appears before a portion of the adjusted trace could be recorded, make a notation at the point of adjustment.

(5) Wait for the next low reference signal trace to complete the adjustment.

b. Once the radiosonde set is in flight, any drift will be considered as a drift for all signals and proportionate to the frequency being recorded. Corrections for this proportionate drifting will be applied while completing flight record. Do not readjust the REF. ADJUST knob except under the condition stated in *a* above.

c. Because of the reflecting effect of nearby objects, a rapid drift may occur immediately after release of the radiosonde set; therefore, the first low reference signal in flight may be expected to record off the 95 ordinate line. This rapid drift (or shift) is accounted for later in the application of corrections, the same as the more gradual drifts of the higher altitude traces.

d. The operator must determine whether the frequency variation of the low reference signal occurs as a drift or a shift. Shifts occurring between low reference signals may be spotted in the temperature and humidity traces. A sudden change in the audio note from the loudspeaker (not caused by a changeover in data recording) indicates a shift and informs the operator of the time of occurrence. Drifts are created by gradual changes within the radiosonde set and show up as such on all traces. A shift either in the temperature or humidity trace that does not show up in the other traces indicates a significant change in meteorological information. It is important that the operator give the equipment continuous attention during a recording.

e. When an automatic time print is required for evaluation of wind data, place the rawin time-print switch in the AUTO. position. When additional time-prints are required of intermediate points, the rawin time-print switch is operated in the MAN. position for each time-print.

3–13. Chart Drift

To avoid inaccuracies caused by possible drift of the chart paper, check the zero line at the end of the descent record. With the SIGNAL SELECTOR switch on S.C., the trace still should lie exactly on the chart zero line. For accurate chart alignment, refer to paragraph 4–11.

3–14. Record Evaluation

a. General. Accomplish the radiosonde recorder sensitivity and zero check as described in paragraph 3–9. The final ordinate values for the temperature and humidity traces are affected by corrections for both linearity and low reference drift. The levels at which evaluations are made (significant levels) are specified by the using service. Ground check observations (para 3–10) are entered on the chart (figs. 3–7 and 3–8). These data include the station pressure, temperature, relative humidity, and pressure contact (commutator setting) at release, time of release, and any other information specified by the using service. Enter

the actual pressure contact setting next to the release trace, enter circled dots on the first level (SFC) and label each as "T" and "RH" as appropriate.

b. Selection, Identification, and Evaluation of Significant Levels.

(1) Significant levels are placed on the radiosonde recorder record to mark the boundaries of strata having differences in temperature lapse rates or vertical humidity gradients (fig. 3–7).

(2) A significant level is drawn completely across the radiosonde recorder record at that point and each level is numbered consecutively.

(3) The first significant level is always the release point. Determine the contact number (to the nearest tenth) at release, and enter this on the surface level slightly to the left of the temperature trace. Do not enter ordinate values for temperature or relative humidity on the surface level.

(4) At each significant level selected, enter the pressure contact number (to the nearest tenth) to the left side of the temperature trace. Enter the ordinate value (to the nearest tenth) of the temperature trace on the top of the line drawn for the significant level, just to the right of the trace. Enter the ordinate value (to the nearest tenth) of the humidity value under the line drawn for the significant level, below the temperature ordinate.

NOTE

Contact values are counted vertically, starting with the top of the temperature trace, or bottom of the humidity trace. This value is considered the beginning of the contact, and the full contact will extend to the top of the next temperature trace or the bottom of the next humidity or reference trace.

c. Preparation of Data.

(1) At each high and low reference trace on the chart, enter the contact number to the right of the reference trace. However, above the 105th contact, number only the high references.

(2) Connect each low reference trace on the chart with a straight line (termed a drift line), drawn from the upper end of one low reference trace to the lower end of the next trace (fig. 3–7). Normally, this will be a straight line that will coincide with the 95th abscissa line. This line indicates a constant reference frequency of 190 Hz. If a drift occurs in this reference frequency, recordings will be affected along the abscissa line, by an amount that is proportionate to the position of the recording between 0 to 95. Consider such drifts when evaluating the flight record.

(3) To correct for a drift in the low reference frequency, the following example is typical. Assume that the low reference trace has shifted downward to 93.7, and the temperature trace for the same altitude level is 38.6. The decrease at the reference level is 95 — 93.7 = 1.3. Multiply the temperature ordinate value (38.6) by the drift (1.3); this figure is equal to 50.18. Divide the product by the ordinate value of the low reference drift line (93.7). The quotient (.54) is the drift correction. Because the drift was to the left of 95.0, the correction must be added to the temperature ordinate (38.6 + .54 = 39.14). (When a definite shift in the temperature and/or humidity traces occurs, without a corresponding shift in the low reference trace, the recorded data above the level are questionable.)

3–15. Pressure Evaluation

Each radiosonde modulator is supplied with a pressure calibration chart, having a serial number which corresponds to the serial number of the radiosonde modulator. The calibration chart of one radiosonde modulator cannot be used to evaluate the flight of another.

a. The low reference, high reference, temperature, or humidity trace that occurs at any point of the chart corresponding to a particular contact on the commutator identifies the pressure at that point.

b. Read the contact indication from the frequency-time recorder chart for the significant level selected. On a strip-type calibration chart, read vertically on the right-hand side until the contact value is matched. Read the millibar pressure on the left side. When a graph-type chart is used (hypsometer), read vertically along the graph line that represents the contact to the calibration curve. Read the pressure from the horizontal line at the intersection of the contact line and the calibration curve.

c. Check the release contact setting on the chart by counting back from the first complete reference after release. The fractional value of the contact at release can be estimated by comparing it with the length of the following contact.

(1) If the difference between the actual setting and the indicated setting is .5 contact or less,

the pressure contact for significant levels should be corrected by the amount of the contact discrepancy.

Example: The record shows that the radiosonde was released with the contact point set at contact 8.4, but the calibration chart indicates that the setting should have been 8.2. The difference is .2 contact. Because the actual setting is higher than the correct setting (as obtained from the calibration chart), .2 should be subtracted from the contact value at the surface and at all significant levels. If the actual setting is low, add the difference to the contact values at the surface and at all significant levels.

(2) If the difference between the actual setting and the indicated setting is greater than .5 contact, the correction method described in (1) above may be applied. However, because of the difference in the physical dimensions of the intermediate conducting segments, using this method may cause slight pressure errors.

NOTE

Contact discrepancies greater than .5 contact are caused by careless ground procedures.

3-16. Temperature-Humidity Computation

(fig. 3-9)

Computer, Humidity-Temperature CP-223(*)/UM is used to translate the recorded data into temperature in degrees Celsius and relative humidity percentage. The computer consists of three discs. The outermost disc is graduated in degrees Celsius. The middle disc is graduated in units that represent recorder chart frequency ordinates. The inner disc contains curved relative humidity lines. A cursor having a hairline is provided for aligning points on the discs. The cursor is also graduated in degrees Celsius.

NOTE

The plain, the "A" model, and "B" model computers should be converted to the "C" model by changing the top (humidity) disc. The top disc for the "C" model is shown in Fig. 3-10 and is labelled CP-223C/UM. To change the disc, requisition new disc (NSN 6660-00-179-5846) and change discs by unscrewing the knurled nut. Discard old disc.

a. Temperature Setting and Determination.

(1) Loosen the knurled knobs enough to permit the disks to be rotated easily. If the knobs are backed off too far, the disks may become uncentered. Check to see that -40°C on the cursor is always on the innermost circle.

(2) Set the hairline of the cursor at the ground check temperature on the outermost disk.

(3) Rotate the recorder divisions middle disk until the ordinate value that corresponds to the ground check temperature trace intersects the hairline of the cursor.

(4) Lock the two disks together by turning the inside knurled knob.

(5) Opposite any temperature ordinate on the CP-223C/UM, read the corresponding temperature in degrees centigrade.

b. Humidity Setting and Determination.

(1) Set the hairline of the cursor at the ordinate value on the CP-223C/UM divisions middle disk that corresponds to the ground check humidity trace.

(2) Rotate the inside humidity disk until the line corresponding to the ground check relative humidity intersects the hairline at the ground check temperature on the cursor. Interpolate between the curved lines on the humidity disk as necessary.

(3) Lock the two disks together by turning the collar-type outside knurled knob.

(4) To prevent the disks from slipping during flight evaluation, place a small piece of masking tape across the adjoining surfaces of the disks.

(5) For any humidity value, set the hairline on the cursor at the humidity ordinate value and read the humidity under the temperature value on the cursor, interpolating as necessary between the curved lines.

3-17. Temperature Record Evaluation

a. Perform the procedure for locking in the ground check temperature data (para 3-16*a*).

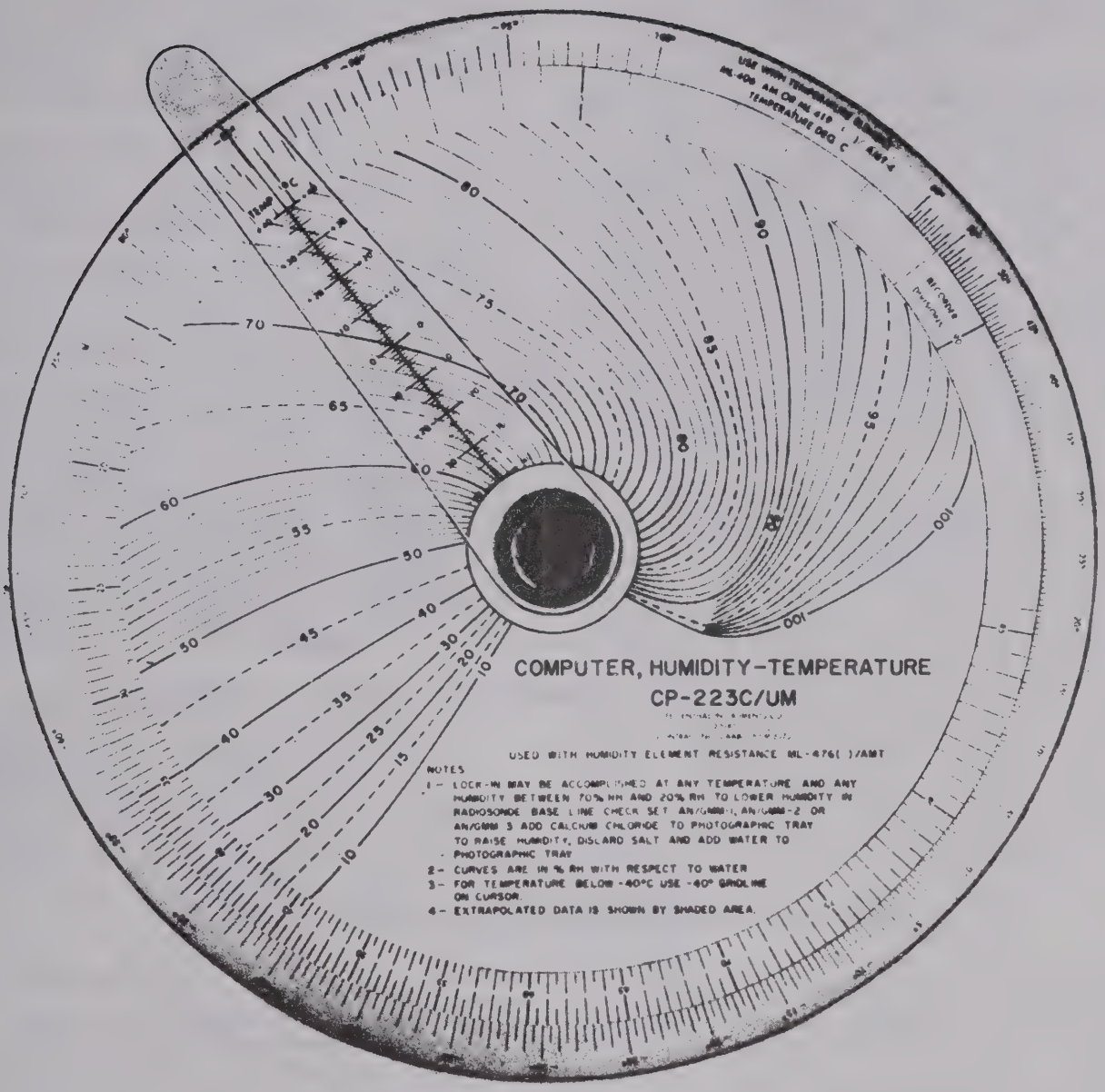
COMPUTER, HUMIDITY-TEMPERATURE
CP-223C/UM
USED WITH HUMIDITY ELEMENT RESISTANCE ML-476( )/AMT
NOTES
1- LOCK-IN MAY BE ACCOMPLISHED AT ANY TEMPERATURE AND ANY HUMIDITY BETWEEN 70% RH AND 20% RH TO LOWER HUMIDITY IN RADIOSONDE BASE LINE CHECK SET AN/GMD-1, AN/GMD-2 OR AN/GMD 3 ADD CALCIUM CHLORIDE TO PHOTOGRAPHIC TRAY TO RAISE HUMIDITY, DISCARD SALT AND ADD WATER TO PHOTOGRAPHIC TRAY
2- CURVES ARE IN % RH WITH RESPECT TO WATER
3- FOR TEMPERATURE BELOW -40°C USE -40° GRADLINE ON CURSOR.
4- EXTRAPOLATED DATA IS SHOWN BY SHADED AREA.

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Figure 3-9. Computer, Humidity — Temperature CP-223C/UM.

b. Move the cursor until the hairline is over the corrected temperature ordinate that is determined for the temperature trace at the desired significant level (para 3-14*b*).

c. Determine the value of the temperature on the temperature plate, as indicated by the cursor hairline. This is the actual temperature at the significant level on the chart.

Example: At the time of release, the ground check temperature was 19.3°C and the temperature trace, as read on the recorder chart, was 66.1 ordinates. At the desired significant level, the temperature trace is 42.3 ordinates. To obtain the correct temperature, lock the ground check temperature at the ground temperature trace (para 3-15). Rotate the cursor until the hairline is at 42.3 recorder ordinates. The actual temperature is then read as —14.6° C.

CAUTION

Loosen the knurled knobs enough to permit the disks to be rotated easily. If the knobs are backed off too far, the disks may become uncentered. Check to see that -40°C on the cursor is always on the innermost circle.

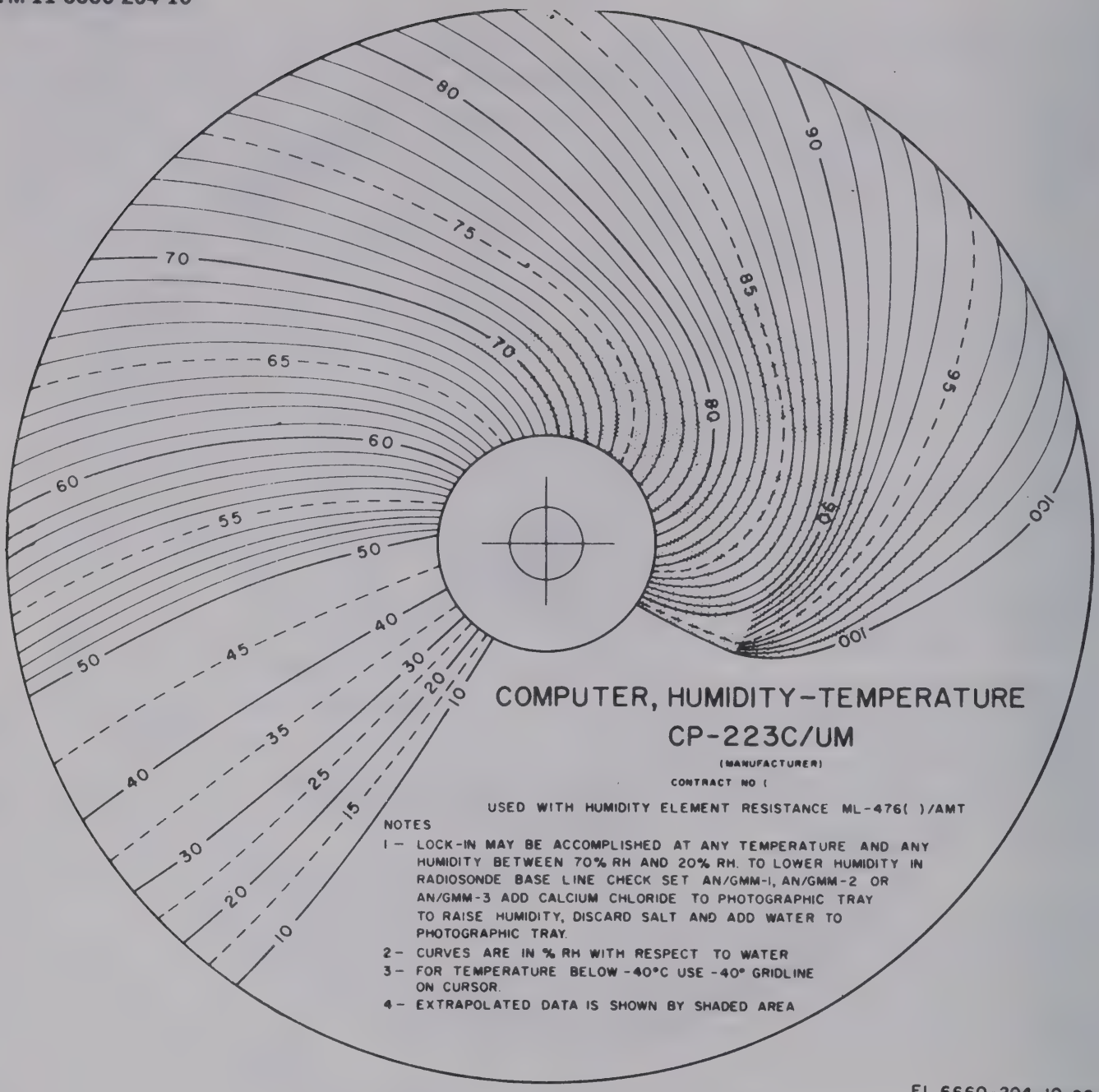
COMPUTER, HUMIDITY-TEMPERATURE
CP-223C/UM
(MANUFACTURER)
CONTRACT NO (
USED WITH HUMIDITY ELEMENT RESISTANCE ML-476( )/AMT
NOTES
1 - LOCK-IN MAY BE ACCOMPLISHED AT ANY TEMPERATURE AND ANY HUMIDITY BETWEEN 70% RH AND 20% RH. TO LOWER HUMIDITY IN RADIOSONDE BASE LINE CHECK SET AN/GMM-1, AN/GMM-2 OR AN/GMM-3 ADD CALCIUM CHLORIDE TO PHOTOGRAPHIC TRAY TO RAISE HUMIDITY, DISCARD SALT AND ADD WATER TO PHOTOGRAPHIC TRAY.
2 - CURVES ARE IN % RH WITH RESPECT TO WATER
3 - FOR TEMPERATURE BELOW -40°C USE -40° GRIDLINE ON CURSOR.
4 - EXTRAPOLATED DATA IS SHOWN BY SHADED AREA
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Figure 3-10. Top disk of Computer, Humidity-Temperature CP-223C/UM.

3-18. Humidity Data Evaluation

a. General. Generally, the humidity traces on the chart will show greater variations than the temperature traces. They usually are evaluated at a point where the significant levels intercept the tops of the traces, or where the levels intercept a straight line that connects the top ends of the humidity traces above and below the significant level. Therefore, draw a straight line that connects the top of each humidity trace to the top of the succeeding humidity trace. Connect all consecutive humidity traces for the entire flight.

NOTE

For exceptions to the following procedure, refer to Federal Handbook #3 Radiosonde Observations, January 1969, U.S. Department of Commerce, with applicable amendments and addenda.

b. Data Record.

(1) Read the humidity ordinate in tenths of a recorder division of the recorder chart.

(2) Read the corrected humidity ordinate at the intersection of the humidity curve and the sig-

nificant level. The procedure for correcting the humidity trace is given in paragraph 3-14c(3). Be sure to select the humidity trace, rather than the temperature trace, when finding the proportional drift of the humidity trace.

c. Humidity Evaluation.

(1) Lock-in the humidity setting for ground check humidity data (para 3-15c).

(2) Move the cursor until the hairline lines up with the corrected humidity trace (para 3-14c(3)) that is determined at the specific significant level under evaluation.

(3) Locate the point on the graduated cursor that identifies the value of the temperature at this same significant level.

(4) Read the value of the relative humidity for this level from that curve, in the family of black curves, that intersects the hairline of the cursor at this temperature. If no curve intersects the hairline, the humidity value can be determined by interpolation between humidity curves.

NOTE

Interpolation between humidity lines is made along the hairline of the cursor.

Example: At a given level, the humidity reading is 69.5 recorder divisions. The temperature at the same level is —7° C. The humidity reading at ground is 80.2 recorder divisions, corresponding to a ground humidity of 71 percent and ground temperature of 19.3° C. Give the indicated relative humidity.

Solution: Rotate the cursor until its hairline is aligned with the 80.2 recorder division mark. Move the center disk until the correct humidity curve, corresponding to the true relative humidity of 71 percent, intersects the hairline graduations of the ground temperature (19.3° C). Lock the two plates by turning the outside knurled knob. Move the cursor until the hairline is at 69.5 recorder divisions. The relative humidity when using Computer, Humidity-Temperature CP-223 C /UM (figs. 3-9 and 3-10) is approximately 76.5 percent.

3-19. Flight Termination

After the record has been completed, operate the recorder with the SIGNAL SELECTOR switch in the S.C. position to obtain a zero check. Stop the recorder by setting the power switch to the POWER OFF position. Advance the chart, with the manual advance knob, until the zero trace is approximately halfway past the lower edge of the tear-off scale; leave enough of the zero trace to indicate correct calibration. Carefully rip the chart against the lower edge of the tear-off scale. Enter the reason for termination of the sounding slightly above the last ascent level evaluated.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

3-20. General

The operation of Radiosonde Recorder AN/TMQ-5(*) may be difficult in regions where extreme cold, heat, humidity and moisture, sand conditions, etc., prevail. Instructions for minimizing the effect of unusual operating conditions are given in paragraphs 21 through 23.

3-21. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the efficient operation of the equipment. Instructions and precautions for operation under such adverse conditions follow:

a. Handle the equipment carefully.

b. Keep the equipment warm and dry. Check to see that the pen heater is operating properly. Leave the power switch at STAND BY when the set is not used, unless this will overtax the alternating current (ac) power source.

c. Locate the equipment inside a heated inclosure, where there is no danger of a cold draft striking the glass tubes. A sudden draft of cold air may shatter the glass envelope of a heated tube. If the inclosure is so constructed that this precaution is impossible, place a blanket or some barrier between the source of the draft and the equipment.

d. When equipment that has been exposed to the cold is brought into a warm room, condensation will form until it reaches room temperature. Open the vent on top of the radiosonde recorder and start the fan. The circulating air will dry the equipment.

3-22. Operation in Tropical Climates

a. For operation in tropical climates, the equipment may be installed in tents, huts, or, when necessary, in underground dugouts. In the tropics, when equipment is installed below ground, or when it is set up in swampy areas, moisture condi-

tions are acute. Ventilation is usually very poor, and the high relative humidity causes condensation of moisture on the equipment whenever its temperature becomes lower than that of the surrounding air. To minimize this condition, keep the fan in operation and the vent open.

b. During periods of inactivity, the lower viscosity of the ink (caused by high temperature) allows it to seep by the ball point and form a drop. If this drop becomes large enough to reach the chart, capillary (blotting) action starts. In sufficient time, this action will drain the ink supply and necessitate a cleaning operation. Avoid this condition by placing a piece of metal foil directly under the pen point. The foil should be from 1 to 2 inches square; it is usually available in protective coverings such as cigarette, gum, and candy wrappings.

3–23. Operation in Desert Climates

a. Conditions similar to those encountered in tropical climates often prevail in desert areas. Use the same protective measures to insure proper operation of the equipment.

b. The main problem that arises with equipment operation in desert areas is the large amount of sand, dust, or dirt that enters the moving parts of the recorder, such as motors and linkage. The ideal preventive precaution is to house the equipment in a dustproof shelter. Since such a building is seldom available and would require air conditioning, the next best precaution is to make the building in which the equipment is located as dustproof as possible with available materials. Hang wet sacking over the windows and doors, cover the inside walls with heavy paper, and secure the side walls of tents with sand to prevent their flapping in the wind.

c. Never tie power cords, signal cords, or other wiring connections to either the inside or the outside of tents. Desert areas are subject to sudden wind squalls, which may jerk the connections loose or break the lines.

d. Keep the equipment as free as possible from dust. Make frequent preventive maintenance checks.

CHAPTER 4

OPERATOR'S MAINTENANCE INSTRUCTIONS

Section I. PREVENTIVE MAINTENANCE

4–1. Scope of Operator's Maintenance

The maintenance duties assigned to the operator of Radiosonde Recorder AN/TMQ–5(*) are listed below together with references to the paragraphs covering specific maintenance functions.

a. Operator's preventive maintenance checks and services (para 4-5).

b. thru *d.* (Deleted)

e. Cleaning (para 4–9).

f. Operator's troubleshooting (para 4–12).

g. Repairs and adjustments (para 4–13).

(1) Chart alignment.

(2) Replacement of humidity-temperature computer.

(3) Replacement of power indicator lamp.

(4) Replacement of filament indicator lamps.

(5) Replacement of chart (Graph Paper ML–432/TMQ–5).

(6) Replacement of recorder pen ink.

4–2. Tools, Test Equipments, and Materials

No tools or test equipments are required for operator's maintenance. Materials for maintenance that the operator is authorized to perform is limited to the following:

a. Computer, Humidity-Temperature CP–223C/UM.

b. Lamp, glow NE–51.

c. Lamp LM–27.

d. Trichlorotrifluoroethane.

Section II. OPERATOR'S PREVENTIVE MAINTENANCE

4–3. Operator's Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to assure that the equipment is serviceable. The procedures given in paragraph 4-5 and 4-9 cover routine systematic care and cleaning essential to proper upkeep and operation of equipment.

4–4. Preventive Maintenance Checks and Services

Preventive maintenance checks and services of Radiosonde Recorder AN/TMQ–5(*) are required on a daily, weekly, and monthly basis.

a. Paragraph 4–5 specifies preventive maintenance checks and services that must be accomplished and under the special conditions listed below.

(1) *Vehicular installations.*

(*a*) Before the vehicle starts on a mission.

(*b*) When the equipment is initially installed.

(*c*) When the equipment is reinstalled after removal for any reason.

(*d*) At least once each week if the equipment is not used daily, but is maintained in a standby condition.

(2) *Fixed, transportable, and mobile installations.*

(*a*) When the equipment is initially installed.

(*b*) When the equipment is reinstalled after removal for any reason.

(*c*) At least once a week, if the equipment is not used daily, but is maintained in a standby condition.

b. Paragraph 4-5 specifies the preventive maintenance that must be performed.

4-5. Operator's Preventive Maintenance Checks and Services

NOTE

The checks in the "Interval" column are to be performed in the order listed.

B — Before operation

Item No.	Interval B	Item to be inspected Procedure	Equipment is not ready/available if:
1	*	Recorder pen. Ensure that pen is clean and filled with ink as explained in paragraph 3-3.	Equipment fails to support assigned mission.
2	*a.*	Radiosonde Recorder AN/TMQ-5(*) performance check. Perform operational tests described in paragraph 4-11.	Equipment fails to support assigned mission.

*Do this check before each deployment to a mission location. This will permit any existing problems to be corrected before the mission starts. The check does not need to be done again until redeployment.
a. Perform after deployment, before operation and as required.

4-6. Deleted

4-7. Deleted

4-8. Deleted

4-9. Cleaning Checks

a. Inspect the exterior of the radiosonde recorder. The exterior surfaces should be clean, free of dust, dirt, grease, and fungus. Interior cleaning is not to be performed by the operator. When it becomes necessary to clean the interior of the equipment, refer the equipment to authorized maintenance personnel.

b. Inspect the interior by pulling the frequency-time recorder chassis forward and opening the recorder window. The interior should be free of dust, dirt, grease, fungus, and ink spashes. If cleaning is necessary, refer the equipment to qualified maintenance personnel.

c. While inspection of the interior is being made, the operator should carefully inspect the pen assembly for cleanliness. If the need for cleaning is apparent, it should be done by qualified maintenance personnel.

4-10. Operational Tests

a. General. Determination of operational capability is accomplished by means of the operational tests chart (para 4-11). The chart gives the item to be tested, the conditions under which the item is tested, the normal indications of correct operation, and the corrective measures the operator can take. To use this chart, follow the items in numerical sequence.

b. Action or Condition. For some items, the information given in the *Action or condition* column of the chart consists of various switch and control settings under which the item is to be tested (para 2-12). For other items, it represents an action that must be taken to allow the operator to look for normal indications given in the *Normal indications* column.

c. Normal Indications. The normal indications listed in the chart include the visible and audible signs that the operator should observe when the items are tested. If the indications are not normal, the operator should apply the recommended corrective measures.

d. Corrective Measures. The corrective measures listed are mainly those the operator can make without turning in the equipment for repairs. If the equipment is completely inoperative, or if the recommended corrective measures do not yield results, troubleshooting is necessary and repairs should be referred to authorized maintenance personnel. However, if the tactical situation requires that the set be kept in operation and the set is not completely inoperative, the operator must maintain the set in operation as long as possible.

4-11. Operational Test Procedures

Item No.	Item	Action or condition	Normal indications	Corrective measures
1	Signal and power cable(s).	Cable(s) connected in accordance with paragraph 2-8.		
2	Circuit breakers.	Set to ON.		
3	SIG SEL switch.	Rotate to S.C.		
4	SPEAKER VOL. control.	Set to desired amount of volume.		
5	OPERATE-LOCK control.	Rotate OPERATE-LOCK control to OPERATE position.		
6	Vent.	Opened.		
7	FAN switch.	Set to OFF.		
8	POWER switch.	Set to OFF.		
9	Chart feed.	Rotate manual chart advance knob clockwise.	Chart advances smoothly and without drift.	Check chart installation and alinement. Refer to higher category of maintenance.
10	POWER switch and FAN switch.	Change POWER switch from OFF to STANDBY and place the FAN switch to ON.	Voltmeter indicates between 105 and 125 volts. Frequency meter indicates between 50 and 65 hertz. Power jewel indicator illuminates.	Check circuit breakers, cabling, and power source. Refer to higher category of maintenance. Replace lamp. Refer to higher category of maintenance.
			Fan motor starts and forces air from vent at top of recorder.	Check vent and filter. Refer to higher category of maintenance.
			Recorder pen goes to zero (approximately) but remains lifted from the chart.	Check installation of pen. Refer to higher category of maintenance.

NOTE

The accuracy of items 11 through 18 are determined by a satisfactory warmup time of 10 to 15 minutes depending on the ambient temperature.

Item No.	Item	Action or condition	Normal measures	Corrective
11	POWER switch.	Change from STAND-BY to ON.	Chart motor starts and drives the chart. Pen sets down and marks the chart at zero.	Refer to higher category of maintenance. If pen does not ride against the chart, check the position of the intermediate chart guide rod, the OPERATE--LOCK control, SENSITIVITY, PEN LIFT control, and pen installation. If pen rides against the chart but does not print, clean and/or fill the pen.
12	REC ZERO control.	Rotate REC ZERO control between limits. Adjust to cause the pen to print at zero.	Pen records below and above zero. Final setting produces a print at zero on the chart.	Refer to higher category of maintenance.
13	REC TEST switch.	Press until check is finished, then release.	Pen lifts and moves to 95 and marks the chart. When switch is released, pen returns to previous setting.	If pen comes to rest above or below 95, check setting of REC TEST ADJ. Refer to higher category of maintenance.
14	60 C.P.S. check.	Rotate SIG SEL switch to 60 C.P.S. (Adjust SPEAKER VOL. as desired.)	Pen lifts from the chart and moves upscale, then sets down and marks the chart at 30 or to a position corresponding to one-half of the line frequency.	If pen comes to rest above or below 30, check setting of REF ADJ. control. Refer to higher category of maintenance.
			A 60 hertz tone is heard from the speaker.	Refer to higher category of maintenance.
15	SPEAKER VOL.	Vary the setting of the of the SPEAKER VOL. control.	Loudness of tone from the loudspeaker changes. Control operates smoothly without producing noise in the tone.	Refer to higher category of maintenance.
16	REF ADJUST control.	Rotate the REF ADJ. handwheel fully clockwise. When check completed, readjust as for item 14.	Pen moves upscale and records 35 ordinates or higher.	Refer to higher category of maintenance.
17	120 C.P.S. check.	Rotate SIG SEL switch to 120 C.P.S.	Pen lifts from the chart and moves upscale and marks the chart at 60 or to a position corresponding to the line frequency.	Refer to higher category of maintenance.
18	SIG check. (If a signal source is not available from the rawin set or frequency standard, omit this step and leave the switch to to either the 60 or 120 C.P.S. setting.)	Rotate SIG SEL switch to SIG.	Pen records at values equal to one-half the input frequency. The audio tone is heard from the speaker. Pen lifts each time the signal frequency is changed.	Check cable connections, signal source. Refer to higher category of maintenance.
19	INTER S.C.-OUTPUT S.C. switch.	Set INTER S.C.-OUTPUT S.C. switch to OUTPUT S.C. Hold until pen stops.	Pen goes to zero.	Refer to higher category of maintenance.
		Set switch to INTER S.C. Hold until pen stops.	Pen goes to zero.	Refer to higher category of maintenance.
20	CHART SPEED INS/MIN. (Frequency-Time-Recorders RD-88A/TMQ-5 and RD-88B/TMQ-5 have two-speed (1/2 and 1) chart drive mechanisms. RD-88C/TMQ-5 has three speed capabilities (1/2, 1, and 2).	Set at 1/2.	Chart advances 1/2 inch per minute.	Refer to higher category of maintenance for defects in the chart speed.
		Set at 1.	Chart advances 1 inch per minute.	
		Set at 2. (RD-88C/TMQ-5 only.)	Chart advances 2 inches per minute.	

Item No.	Item	Action or condition	Normal indications	Corrective measures
21	Rawin time-print (TPO). AUTO.-OFF-MAN switch. (If the recorder is not connected to the rawin set, omit this test).	Set to OFF.	Control recorder TPO (Time-Print-Only) does not operate for any pen position on the scale.	Refer to higher category of maintenance.
		Set to AUTO.	Control recorder produces TPO when pen exceeds 89 to 91 chart ordinates.	Refer to higher category of maintenance.
		Depress switch to MAN.	Control recorder produces TPO each time switch is depressed.	Refer to higher category maintenance.
22	POWER switch.	Set POWER switch.	Jewel power indicator lamp goes out and VOLTAGE and FREQUENCY meters indicate zero.	Refer to higher category of maintenance.

4-12. Operator's Troubleshooting Chart

All corrective measures that the operator can perform are given in the *Checks and corrective actions* column. If the action does not correct the fault, additional maintenance must be performed by maintenance personnel. The operator should note on the repair item how the equipment performed and what corrective measures were taken. Follow each step in the order given to locate the trouble; however, if trouble is suspected in a particular area, start checking at that point and continue with the steps in sequence.

Item No.	Trouble symptom	Probable trouble	Checks and corrective actions
1	Chart creeps to either side.....	Chart misalignment.....	Align as described in paragraph 4-14.
2	Power indicator lamp does not light with circuit breaker at ON and power switch in POWER ON or STAND BY position.	*a.* If POWER LINE VOLTAGE and POWER LINE FREQUENCY meters indicate voltage and frequency, power indicator lamp is defective.	*a.* Replace as described in paragraph 4-16.
		b. If POWER LINE VOLTAGE and POWER LINE FREQUENCY meters do not indicate, radiosonde recorder is not receiving power.	*b.* Check cable to power source and repair or replace as required.
3	POWER LINE VOLTAGE meter does not indicate between 105 to 125 volts.	Power source voltage.....	Check cable to power source. Adjust, repair, or replace as necessary.
4	POWER LINE FREQUENCY meter does not indicate between 50 to 65 cycles.	Power source frequency out of limits.....	Adjust power source if a generator is used; otherwise, refer to higher category of maintenance.
5	Pen does not record at zero with the SIGNAL SELECTOR switch in the S.C. position.	REC. ZERO potentiometer is out of adjustment.	Adjust as described in paragraph 3-8.
6	Pen goes above 96 on chart when REC. TEST switch is depressed.	REC. TEST potentiometer is out of adjustment.	Adjust as described in paragraph 3-8.

Section III. ADJUSTMENT, REPAIR, AND REPLACEMENT OF PARTS

4-13. Repair and Adjustment

a. Repairs. Any repair necessary with the exception of those removals, replacements, and adjustments listed in paragraphs 4-14, 4-15, and 4-16 is to be performed by authorized maintenance personnel only and not the operator.

b. Adjustments. Normal adjustments for presetting, preliminary starting, and starting newly installed equipment replacements are to be made by the operator. Procedures for these adjustments are found in paragraphs 3-6 through 3-11. After a repair has been made, the operator will determine if any adjustments are necessary by following the steps outlined in *a* through *d* below, after allowing for the initial warmup period of the recorder (para 3-7).

(1) *Step 1.*

(a) Set the power switch to POWER ON. The pen should record at zero on the chart (SIGNAL SELECTOR switch still in S.C. position).

(*b*) If the pen does not record at zero, adjust the REC. ZERO control until the pen does record at zero.

(*c*) Hold the REC. TEST switch in the down position; the pen should go to 95 graph divisions and mark the chart.

(*d*) Release the REC. TEST switch; the pen should return to zero and mark the chart.

NOTE

If this movement is sluggish, adjust the SENSITIVITY control.

(2) *Step 2.* Rotate the SIGNAL SELECTOR switch to 60 C.P.S. The pen will go to 30 on the chart or will be adjustable to 30 by rotating the REF. ADJUST knob. A 60-cycle signal is heard in the speaker.

(3) *Step 3.* Rotate the SIGNAL SELECTOR switch to 120 C.P.S. The pen will go to 60 on the chart or will be adjustable to 60 by rotating the REF. ADJUST knob. A 120-cycle signal should be heard in the speaker.

(4) *Step 4.* Rotate the SIGNAL SELECTOR switch to SIG. The recorder is now ready to receive and record signals.

4–14. Chart Alignment

If the chart creeps to the right or left (as shown by increasing misalignment between the punched holes and the roller teeth on the left-hand end of the roller) as it advances, make the following adjustments:

a. Loosen the nut on the threaded stud that supports the left-hand chart roll bearing (fig. 3–6).

b. Reposition the stud in a direction opposite that of the chart misalignment; estimate the amount of shift required for a trail.

c. Tighten the nuts (be sure that the stud does not turn and disturb the new alignment).

d. Align the chart on the roller again. Check the guide collar on the intermediate guide rod; it should just contact the left edge of the chart. If the guide collar requires repositioning, contact organizational maintenance personnel.

e. Make another trial run of the chart, and repeat the preceding adjustments until the chart advances properly.

f. These adjustments may be necessary each time a new chart is installed.

4–15. Removal and Replacement of Humidity-Temperature Computer (fig. 3–9)

a. Removal.

(1) Loosen and remove the inner knurled locknut by turning it counterclockwise.

(2) Carefully lift the cursor and top disk from the assembly.

b. Replacement.

(1) Place disk onto assembly.

(2) Install cursor onto assembly.

(3) Replace and fingertighten knurled locknut by turning clockwise.

4–16. Removal and Replacement of Power Indicator Lamp (fig. 3–1)

a. Removal.

(1) Remove lens by unscrewing in a counterclockwise direction.

(2) Remove bayonet type NE–51 lamp by grasping lamp with fingers, pushing into socket, and turning slightly in the counterclockwise direction.

b. Replacement.

(1) Install lamp by pushing into socket and turning clockwise.

(2) Replace lens by screwing clockwise.

CHAPTER 5

SHIPMENT AND LIMITED STORAGE

5-1. Field Packaging Instructions

As a guide in preparing Radiosonde Recorder AN/TMQ-5(*) for shipment and limited storage, use the following instructions (fig. 2-1 and 2-2).

a. Detail Requirements.

(1) *Packaging.* Package Radiosonde Recorder AN/TMQ-5(*) as follows:

(a) Technical manual. Package each technical manual within a close-fitting bag fabricated of waterproof wrapping paper. Seal the bag securely with waterproof, pressure-sensitive tape.

(b) Electrical Equipment Cabinet CY-1390(*)/TMQ-5 with contents. Block and brace all components in place within the cabinet with pads or cells of corrugated fiberboard. Position cabinet corners and secure the fastenings. Cushion each cabinet with paperboard cushioning and secure the cushioning with gummed paper tape. Overwrap each cushioned cabinet with waterproof paper and secure the waterproof paper with water-resistant tape.

(c) Accessories Case CY-930/TMQ-5 with contents. The accessories case shall be placed within a fiberboard box.

(2) *Packing.* Pack Radiosonde Recorder AN/TMQ-5(*) as follows.

(a) Place Electrical Equipment Cabinet CY-1390(*)/TMQ-5 in a nailed wooden box.

(b) No packing is required for Accessories Case CY-930/TMQ-5.

(c) Strap each nailed wooden box only for intertheater shipment.

(3) *Marking requirements.* Boxes shall be marked as prescribed in MIL-STD-129 and pertinent instructions contained in the movement directive.

b. Estimated Material Requirements.

Item	Quantity
Waterproof wrapping paper	48 sq ft
Paperboard cushioning material	46 sq ft
Tape, pressure-sensitive, adhesive waterproof (2″)	28 ft
Tape, paper gummed, sealing and securing	16 ft
Fiberboard carton	1
Strapping, flat steel (5/8 × 0.020)	68 ft
Wooden shipping boxes	1 ft

c. Packed Weight and Dimensions. Packed weight and dimensions are as follows.

Box No.	Item and Type No.	Inside dimension (in.)			Outside (cu ft)	Lumber[a] (board ft)	Packed weight (lb)
		Length	Width	Depth			
1	Radiosonde Recorder AN/TMQ-5(*). Electrical Equipment Cabinet CY-1390(*)/TMQ-5 with contents.	44	31	28	27	88	490
2	Accessories Case CY-930/TMQ-5 with contents	23	29 1/4	21	9		138

[a]Nominal 1″ lumber.

d. Specification, Standards, and Other Publications. Applicable publications for shipping are as follows.

Specification number	Title	Type	Grade	Class	Federal stock number
QQ-S-781	Strapping, Flat Steel Seal, Steel Strapping	1	2	B	8135-283-0667 8135-236-9842
UU-T-111	Tape Paper, Gummed			2	8135-598-6097
UU-P-271	Wrapping Paper L-2 Waterproof				8135-171-0980
PPP-P-291	Paperboard				8135-281-3970
PPP-T-60	Wrapping Tape, Pressure Sensitive	III		2	8135-281-2700
MIL-STD-129	Marking for Shipment and Storage.				

5-2. **Administrative Storage**

For instructions on administrative storage of Radiosonde Recorder AN/TMQ-5(*), refer to paragraph 1-3.4.

Section II. Deleted.

APPENDIX A

REFERENCES

DA Pam 310-1	Consolidated Index of Army Publications and Blank Forms.
DA Pam 738-750	The Army Maintenance Management System (TAMMS).
TM 11-6660-204-10-HR	Hand Receipt Manual covering content of Components of End Item (COEI), Basic Issue Items (BII) and Additional Authorization List (AAL) for Radiosonde Recorders, AN/TMQ-5 (NSN 6660-00-324-9426), AN/TMQ-5A and AN/TMQ-5B.
TM 11-6660-204-24P-1	Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools for Recording Set, Weather Data AN/TMQ-5C (NSN 6660-00-682-4500).
TM 11-6660-206-12	Operator's and Organizational Maintenance Manual for Rawin Sets AN/GMD-1A (NSN 6660-00-224-6137), AN/GMD-1B (NSN 6660-00-599-8257), AN/GMD-1C (NSN 6660-01-077-7797), and AN/GMD-1D (NSN 6660-01-072-9995).
TM 11-6660-219-12	Operator and Organizational Maintenance Manual, Radiosonde Baseline Check Sets AN/GMM-1 and AN/GMM-1A (NSN 6660-00-527-8392).
TM 11-6660-220-10	Operator's Manual Radiosonde Sets AN/AMT-12 and AN/AMT-12A.
TM 11-6660-222-12	Operator's and Organizational Maintenance Manual: Meteorological (TO 45A2-2-1-2) (AR) (6660-00-239-4015) and ML-7 (6660-00-239-4010); Psychrometers, ML-24 (6660-00-223-5083) and ML-224 (6660-00-223-5084); Instrument Shelter, Meteorological, S-101/UM (5410-00-222-0507); Support, Instrument Shelter, MT-1426/UM (5410-00-408-4807) and Launching Equipments.
TM 11-6660-228-10	Operator's Manual, Radiosonde Sets AN/AMT-4D and AN/AMT-4E (NSN 6660-00-542-1964).
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).

APPENDIX B
COMPONENTS OF END ITEMS LIST

Section I. INTRODUCTION

B-1. Scope

This appendix lists integral components of and basic issue items for the AN/TMQ-5(*) to help you inventory items required for safe and efficient operation.

B-2. General

This Components of End Item List is divided into the following sections:

a. Section II. Integral Components of the End Item. These items, when assembled, comprise the AN/TMQ-5(*) and must accompany it whenever it is transferred or turned in. The illustrations will help you identify these items.

b. Section III. Basic Issue Items. These are the minimum essential items required to place the AN/TMQ-5(*) in operation, to operate it, and to perform emergency repairs. Although shipped separately packed they must accompany the AN/TMQ-5(*) during operation and whenever it is transferred between accountable officers. The illustrations will assist you with hard-to-identify items. This manual is your authority to requisition replacement BII, based on TOE/MTOE authorization of the end item.

B-3. Explanation of Columns

a. Illustration. This column is divided as follows:

(1) *Figure number.* Indicates the figure number of the illustration on which the item is shown.

(2) *Item number.* The number used to identify item called out in the illustration.

b. National Stock Number. Indicates the National stock number assigned to the item and which will be used for requisitioning.

c. Description. Indicates the Federal item name and, if required, a minimum description to identify the item. The part number indicates the primary number used by the manufacturer, which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify an item or range of items. Following the part number, the Federal Supply Code for Manufacturers (FSCM) is shown in parentheses.

d. Location. The physical location of each item listed is given in this column. The lists are designed to inventory all items in one area of the major item before moving on to an adjacent area.

e. Usable on Code. Not applicable. "USABLE ON" codes are included to help you identify which component items are used on the different models. Identification of the codes used in these lists are:

Code	*Used on*
1	AN/TMQ-5
2	AN/TMQ-5A
3	AN/TMQ-5B
4	AN/TMQ-5C

f. Quantity Required (Qty Reqd). This column lists the quantity of each item required for a complete major item.

g. Quantity. This column is left blank for use during an inventory. Under the Rcvd column, list the quantity you actually receive on your major item. The Date columns are for your use when you inventory the major item.

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SECTION II INTEGRAL COMPONENTS OF END ITEM

(1) ILLUSTRATION (A) FIG NO.	(1) ILLUSTRATION (B) ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION PART NUMBER (FSCM)	(4) LOCATION	(5) USABLE ON CODE	(6) QTY REQD	(7) QUANTITY RCVD	(7) QUANTITY DATE
1-4		6660-00-343-0370	CABINET, ELECTRICAL EQUIPMENT: CY-1390/TMQ-5 (80063)		1	1		
1-2		6660-00-343-0370	CABINET, ELECTRICAL EQUIPMENT: CY-1390A/TMQ-5 (80063)		2,3,4	1		
1-2 1-6		6660-00-614-9859	CABINET, SUB-ASSEMBLY, ELECTRICAL EQUIPMENT MX-1482/TMQ-5 (80058)		1 thru 4	1		
		6660-00-306-2126	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: CX-2337/TMQ-5 (80058)		1,2	1		
		6660-00-306-2126	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: CX-2337/TMQ-5 (80058)		3,4	1		
		6660-00-170-8777	CABLE ASSEMBLY, POWER ELECTRICAL: CX-1492/U (80058)		1,2	1		
1-7		6660-00-788-2133	CHART WEIGHT ASSEMBLY: SC-B-125081 (80063)		1 thru 4	1		
1-7		6660-00-752-7794	COMPUTER, HUMIDITY, TEMPERATURE: CP-223A/UM (80063)		1 thru 4	2		
1-4		6660-00-503-0669	CONVERTER, SIGNAL: CV-146/TMQ-5 (80063)		1,2	1		
1-4		6660-00-503-0669	CONVERTER, SIGNAL: CV-146A/TMQ-5 (80063)		3,4	1		
1-2		6660-00-370-3725	DESK LOG: SL-0-125505 (80063)		1 thru 4	1		
1-2		6660-00-569-0403	PANEL, CONTROL: C-834/TMQ-5		1,2	1		
1-3		6660-00-569-0403	PANEL, CONTROL: C-834A/TMQ-5		1 thru 4	1		
1-4		6660-00-553-1946	POWER SUPPLY: PP-968/TMQ-5 (80063)		1,2	1		
		6660-00-553-1946	POWER SUPPLY: PP-968A/TMQ-5 (80063)		3,4	1		
1-1		6660-00-324-9426	RADIOSONDE RECORDER: AN/TMQ-5 (80058)		1	1		
1-1		6660-00-393-2234	RADIOSONDE RECORDER: AN/TMQ-5A (80058)		2	1		
1-1		6660-00-393-2234	RADIOSONDE RECORDER: AN/TMQ-5B (80058)		3	1		
1-1		6660-00-682-4500	RADIOSONDE RECORDER: AN/TMQ-5C (80058)		4	1		
2-3 2-5		6660-00-725-7917	RECORDER, FREQUENCY TIME: RD-88/TMQ-5 (80058)		1			
1-2 1-5		6660-00-503-0713	RECORDER, FREQUENCY TIME: RD-88A/TMQ-5 (80058)		2			
1-2		6660-00-503-0713	RECORDER, FREQUENCY TIME: RD-88B/TMQ-5 (80058)		3			
3-2		6660-00-725-7917	RECORDER, FREQUENCY TIME: RD-88C/TMQ-5 (80058)		4			
1-7		5120-00-236-2140	SCREWDRIVER: SC-A-4225 (80063)		1 thru 4	1		
		6660-00-377-0176	WIRE ROPE ASSEMBLY, SINGLE LEG: SC-B-125626 (80063)		1 thru 4			
1-7		6120-00-293-1839	WRENCH, OPEN END, FIXED: 0.753" AND 0.878" OPENINGS: SC-B-125071 (80063)		1 thru 4	2		
		6660-00-663-7917	PEN, RECORDER SK-5320-598 (31922)		1 thru 4	1		

SECTION III BASIC ISSUE ITEMS

(1) ILLUSTRATION (A) FIG NO.	(1) ILLUSTRATION (B) ITEM NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION PART NUMBER (FSCM)	(4) LOCATION	(5) USABLE ON CODE	(6) QTY REQD	(7) QUANTITY RCVD	(7) QUANTITY DATE
1-7		6660-00-503-0671	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: CX-2338/U (80058)		1 thru 4	5		
1-7		6660-00-503-0672	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: CX-2339/U (80058)		1 thru 4	1		
1-7		6660-00-537-7902	CASE, ACCESSORIES: CY-930/TMQ-5 (81350)		1 thru 4	1		
		6660-00-377-2923	COVER, REAR: SC-D-125704		1 thru 4	1		
		6660-00-392-5691	COVER, FRONT: SC-D-125703		1 thru 4	1		
			DRIVE CABLE					
		5960-00-262-0167	ELECTRON TUBE: 12AT7WA (81349)		1 thru 4	2		
		5960-00-827-8782	ELECTRON TUBE: 12AX7WA (81349)		1 thru 4	2		
		5960-00-188-0933	ELECTRON TUBE: 12AY7 (81349)		1 thru 4	1		
		5960-00-082-4139	ELECTRON TUBE: 5751 (81349)		1 thru 4	1		
		5960-00-262-0210	ELECTRON TUBE: 5814A (81349)		1 thru 4	1		
		5960-00-284-5823	ELECTRON TUBE: 5R4W6A (81349)		1 thru 4	1		
		5960-00-617-6097	ELECTRON TUBE: 6Y6GT (81349)		1 thru 4	1		
		5960-00-167-0389	ELECTRON TUBE: 5651 (81349)		1 thru 4	1		
		5960-00-166-7674	ELECTRON TUBE: 6AS76 (81349)		1 thru 4	1		
		5960-00-166-7663	ELECTRON TUBE: 12AU7 (81349)		1 thru 4	1		
		5960-00-166-7676	ELECTRON TUBE: 6AU6WB (81349)		1 thru 4	1		
		5960-00-669-6861	ELECTRON TUBE: 6005/6AQ5W (81349)		1 thru 4	1		
			FUSES, 0.5 AMP, 3AG SLOW-BLOW		1 thru 4	5		
			FUSES, 0.3 AMP, SLOW-BLOW		1 thru 4	5		
		6240-00-057-2887	INCANDESCENT LAMPS TYPE 44		1 thru 4	2		
		6130-00-330-9728	INVERTER, VIBRATOR: STD-3338-2A (35529)		1 thru 4	1		
		6240-00-223-9100	LAMP, GLOW: T3-1-4 (24446)		1 thru 4	1		
			SLIDE WIRE CONTACT AND HARDWARE		1 thru 4	1		

APPENDIX D
EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

D-1. Scope

This appendix lists expendable supplies and materials you will need to operate and maintain the AN/TMQ-5(*). These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items).

D-2. Explanation of Columns

a. Column 1 – Item number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use cleaning compound, item 5, App. D").

b. Column 2 – Level. This column identifies the lowest level of maintenance that reqires the listed item.

C — Operator/Crew
O — Organizational Maintenance/Aviation Unit Maintenance
F — Direct Support Maintenance/Aviation Intermediate Maintenance
H — General Support Maintenance

c. Column 3 – National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Column 4 – Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Federal Supply Code for Manufacturer (FSCM) in parentheses followed by a part number.

e. Column 5 – Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requiremens.

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SECTION II EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION PART NO. AND FSCM	(5) UNIT OF MEAS
	C	6605-00-149-1439	ALCOHOL, ISOPROPYLE: 5024 (89875)	1 qt
	C	7510-00-270-6168	INK, LEEDS AND NORTHRUP: 125070 (31922)	2 BTL
	C	6660-00-682-6510	PAPER, GRAPH MIL-432A/TMQ-5: SMD-347544 (80063)	13 RL

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USAR: None.
For explanation of abbreviations used, see AR 320-50.

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